STORMWATER MANAGEMENT REPORT

Site Plan of Land
"The Residence at Burns Avene"
Walpole, Massachusetts

February 7, 2019
Revised: May 21, 2020
February 8, 2022
February 23, 2022
May 5, 2022

Prepared for:

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CONTENTS

Introduction:

The applicant, Wall Street Development Corp., is proposing to develop a 40 Unit Condominium project, located off Burns Avenue and Union Street, in Walpole Massachusetts. The proposed project was filed with Massachusetts Housing pursuant to Massachusetts General Laws Chapter 40B. The 40 Units will be townhouse style dwellings in a condominium association. The existing property consists of a single family dwelling and undeveloped wooded area. The total project area consists of 3.61 acres.
The proposal is to raze the existing house at 48 Burns Avenue and 7 Brook Lane. The Project will be serviced by Town water, sewer and other available public utilities. The stormwater generated from the Project will be captured, conveyed, treated and mitigated on-site utilizing Best Management Practices.

The purpose of these calculations is to demonstrate design compliance of the Project's stormwater management system for water quality and quantity, specifically post-development peak discharge rates per the DEP's Stormwater Management Policy, the Town of Walpole Land Subdivision Regulations. As designed, the system will mitigate peak rates of runoff for storms up to and including the 100-year event under post-construction conditions.

Methodology/Sources of Data:

The overall storm water management plan for the project is designed to maintain the peak rate of storm water runoff from the site after development. The Soil Conservation Service Modified Soil Cover Complex Method, the computer program "HydroCAD" by Applied Microcomputer Systems, and the procedures specified in Urban Hydrology for storm Small Watersheds were used to determine pre-and post-developed peak flow rates of runoff from the site. The 2, 10, 25 and 100-year, 24-hour storm frequencies were used in the comparison of pre and post- development conditions. The rainfall data for the Type III, 24-hour storm events follow:

Frequency (Years)	Rainfall (inches)
2	3.25
10	4.90
50	6.10
100	7.00

The storm water runoff will be controlled through the use of "Best Management Practices" and in conformance with the MADEP Stormwater Management Policy.

Soils:

The Natural Resources Conservation Service, Hydrologic Soils Group Map indicates that the on-site soils consist of Sudbury fine sandy loam (260B) in the vicinity of the existing dwelling. The remaining area consist of Scarboro & Birdsall with a hydrologic rating of A/D. On-site soil testing was performed by our office on June 8, 2016. The field testing determined that area has been filled with deleterious material ranging in depth from 52 to 84 inches. The parent material below the fill was classified in the field as fine sandy loam. A conservative infiltration rate of 0.52 inches/hour was utilize in sizing the infiltration basin and roof system. The fill material will be removed below the infiltration systems to the depth of the parent material and replaced with clean sand material that is compliant with Title 5 sand.

The existing surface area material was classified as hydrologic group group D based on the fill material.

Existing Site Conditions:

The project site is located off the Union Street, Brook Lane and the end of Burns Avenue. The existing property consists of a single family house at the end of Burns Avenue and 7 Brook Lane and undeveloped woodlands. The total project area consists of 3.61 acres.
The site slopes from a high point located in the interior, to the south where this is a wetland area and north towards Union Street. The existing stormwater runoff from the site flows via overland flow to the south wetland area and to the north where it enters a culvet under Union Street.

The stormwater runoff generated from the existing site discharges to two (3) design points. Subcatchment 1E flows via overland flow to the wetland area along the southern boundary. Subcatchments 2E and 3E flow via overland towards Union Street and are combined in Link 1L.

Description	Comments
1E	Overland flow southern boundary
1L	Overland flow towards Union Street
4E	Overland flow towards Brook Lane

Post-developed Runoff:

The Project will consist of razing the existing dwelling at the end of Burns Avenue and Brook Lane. The proposed project will consist of the construction of forty (40) townhouse style units with associated driveways, public utilities, and grading. A twenty-four (24) foot wide access road will be constructed from the end of Burns Avenue through to Brook Lane. The Runoff generated from the Project will be collected via deep sump catch basins where it will be conveyed to a leaching chamber and drainage basin for mitigation along the southern boundary. The proposed system will reduce or match all post-development peak flows for all design storms including the 100-year storm event.

The runoff areas have been divided into seven (7) subcatchments. Subcatchments 1D and 2D discharge towards the southern boundary. Subcatchment 1D-1 is directed to leaching chambers thence overflows to the proposed drainage basin. subcatchment 2D-1 and 2D-2 bypasses the basin. The total discharge is combined Link 2L for comparison of offsite impacts.

Subcatchments 3D and 4D discharge towards Union Street. The total flows are combined Link 3L for comparison of offsite impacts. Subcatchment 5D discharges to Brook Lane.

Description	Comments
1D-1, 1D-2	flow into drainage basin
2D-1, 2D-2	Overland bypassing basin
3D	flow towards Union St.
4D	flow towards Union St.
5D	flows toward Brook Lane

For comparison of pre- and post-developed flow rates:

Pre-Developed	Post Developed
1E	2L
1L	3L
4E	5D

The following is a summary comparison of peak flows:

Summary of *Peak* Stormwater Runoff Rates								
Design Point	**2Yr Peak Flow (cfs)**		**10-Yr Peak Flow (cfs)**		**25-Yr Peak Flow (cfs)**		**100-Yr Peak Flow (cfs)**	
	Exist.	***Prop.***	***Exist.***	***Prop.***	***Exist.***	***Prop.***	***Exist.***	***Prop.***
(1E) 2L	2.71	2.02	5.78	3.78	8.20	6.57	10.05	8.68
(1L) 3L	1.45	1.43	3.54	3.36	5.26	4.92	6.60	6.14
4E/5D	1.12	0.91	2.05	1.63	2.74	2.17	3.26	2.57

The following is a summary of the Detention Basin #1:

Summary of Detention Basin 1P								
Design Point	**2-Yr Volume (cu.ft.)**		**10-Yr Volume (ac-ft)**		**25-Yr Volume (ac-ft)**		**100-Yr Volume (ac-ft)**	
	Peak Elev.Ft.	***Outflow (cfs)***	***Peak Elev. Ft.***	***Outflow (cfs)***	***Peak Elev.Ft.***	***Outflow (cfs)***	***Peak Elev.Ft.***	***Outflow (cfs)***
1P	110.06	0.26	110.43	2.53	110.66	4.60	110.79	6.06

The proposed pipe network has been designed to convey stormwater flows for the 25-year storm event.

Summary:

The calculations performed for all design storm events indicate that there is no net increase in the peak rate of runoff or volume for the Project as proposed. Therefore, with the implementation of the stormwater management system as designed, there will be adequate protection against pollutants, flooding, siltation, or other drainage problems. The stormwater management system along with the Operation and Maintenance plan contained herein will satisfy all of the objectives of the DEP's Stormwater Management Regulations and the Town of Walpole Subdivision Rules.

Massachusetts Stormwater Management Standards:

Standard 1: No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the commonwealth:
All new stormwater discharges will be treated and remove a minimum of eighty (80) percent total suspended solids. The surface runoff from the proposed impervious surfaces will be treated and mitigated prior to discharge to abutting properties.

Standard 2: Stormwater management systems shall be designed so that the Post-developed peak discharge rates do not exceed Pre-developed peak discharge rates:
The proposed project as designed will result in no increase in post-development runoff over pre-developed rates. ***See Appendix A.***

Standard 3: Loss of annual recharge to groundwater shall be eliminated or minimized through the use of environmentally sensitive site design, low impact development techniques, stormwater best management practices and good operation and maintenance:
No proposed change from existing.

Standard 4: Stormwater management systems shall be designed to remove 80% of average annual post-construction load of total suspended solids (TSS):
The proposed design will provide treatment and groundwater recharge through the use of an infiltration basin to control runoff from the impervious surfaces.

Standard 5: For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce discharge of stormwater runoff from such land uses to the maximum extent practicable:
The project is not a land use with higher potential pollutant load (LUHPPL).

Standard 6: Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of specific source control and pollution prevention measures and specific structural stormwater best management practices determined by the department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook.
The project site is not located in a Critical area.

Standard 7: A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extend practible:
The proposed project is not a redevelopment.

Standard 8: A plan to control construction-related impacts, including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented:
The proposed project plan set includes an erosion control plan to be implemented during construction period. A Stormwater Pollution Prevention Plan (SWPPP) will be prepared prior to the commencement of construction.

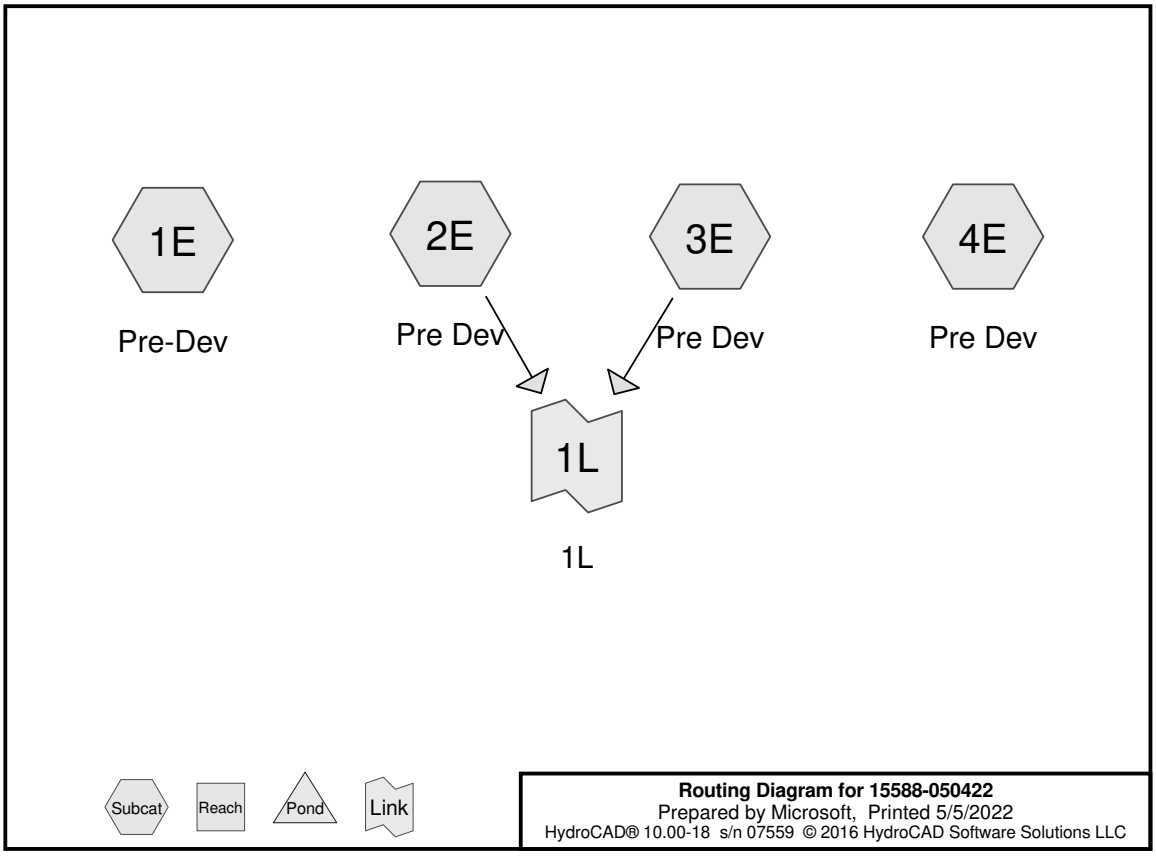
Standard 9: A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed:
A Stormwater Operation and Maintenance Plan are included. ***See Appendix D.***

Standard 10: All illicit discharges to the stormwater management system are prohibited:
An Illicit Discharge Compliance Statement was prepared for the project***. See Appendix E.***

APPENDIX – A1

Calculations for Pre Development

Standard 2:



Summary for Subcatchment 1E: Pre-Dev

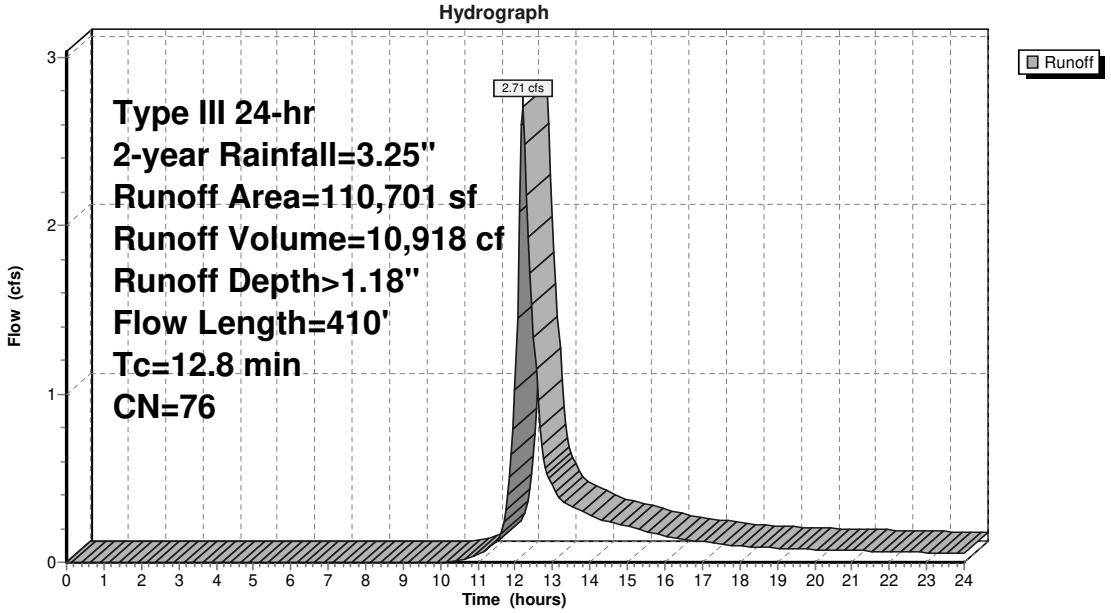
Runoff = 2.71 cfs @ 12.19 hrs, Volume= 10,918 cf, Depth> 1.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.25"

	Area (sf)	CN	Description
	10,228	98	Paved parking, HSG C
	5,535	98	Roofs, HSG C
	24,216	79	50-75% Grass cover, Fair, HSG C
	68,793	70	Woods, Good, HSG C
*	1,929	77	Welands,Woods, Good, HSG D
	110,701	76	Weighted Average
	94,938		85.76% Pervious Area
	15,763		14.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.3	40	0.0100	2.03		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
0.5	90	0.0400	3.22		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
3.8	230	0.0400	1.00		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
12.8	410	Total			

Subcatchment 1E: Pre-Dev



Summary for Subcatchment 2E: Pre Dev

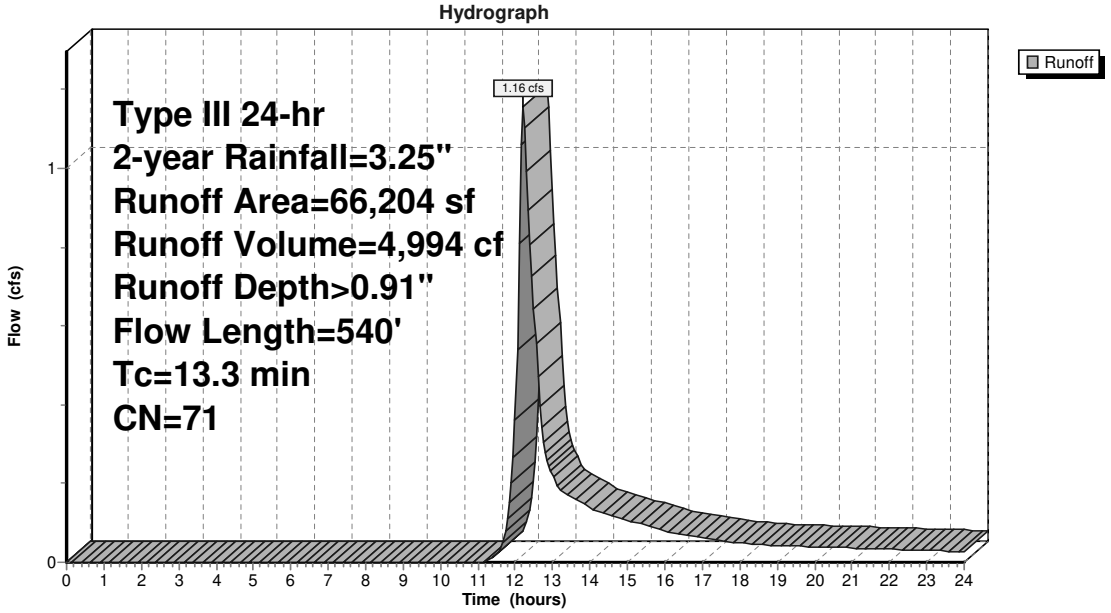
Runoff = 1.16 cfs @ 12.21 hrs, Volume= 4,994 cf, Depth> 0.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.25"

Area (sf)	CN	Description
645	98	Roofs, HSG C
13,669	74	>75% Grass cover, Good, HSG C
51,890	70	Woods, Good, HSG C
66,204	71	Weighted Average
65,559		99.03% Pervious Area
645		0.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.5	70	0.0200	2.28		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
4.1	260	0.0450	1.06		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
0.5	160	0.0170	5.83	34.97	**Channel Flow, D-E** Area= 6.0 sf Perim= 7.0' r= 0.86' n= 0.030 Earth, grassed & winding
13.3	540	Total			

Subcatchment 2E: Pre Dev



Summary for Subcatchment 3E: Pre Dev

Runoff = 0.32 cfs @ 12.16 hrs, Volume= 1,270 cf, Depth> 0.86"

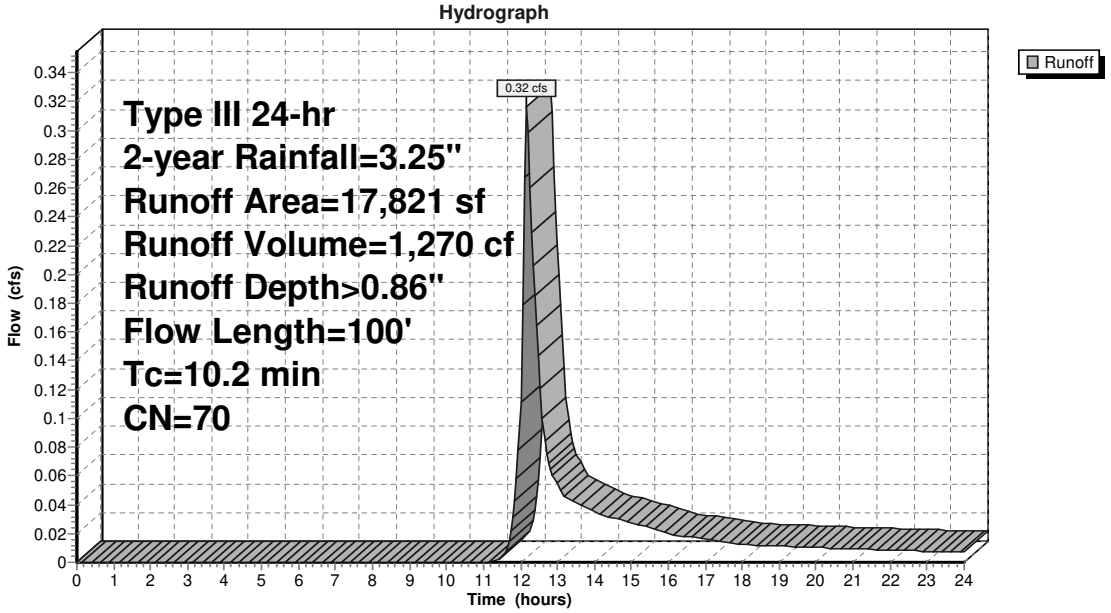
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.25"

Area (sf)	CN	Description
17,821	70	Woods, Good, HSG C
17,821		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.9	50	0.0380	0.97		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
10.2	100	Total			

Subcatchment 3E: Pre Dev

Hydrograph



Summary for Subcatchment 4E: Pre Dev

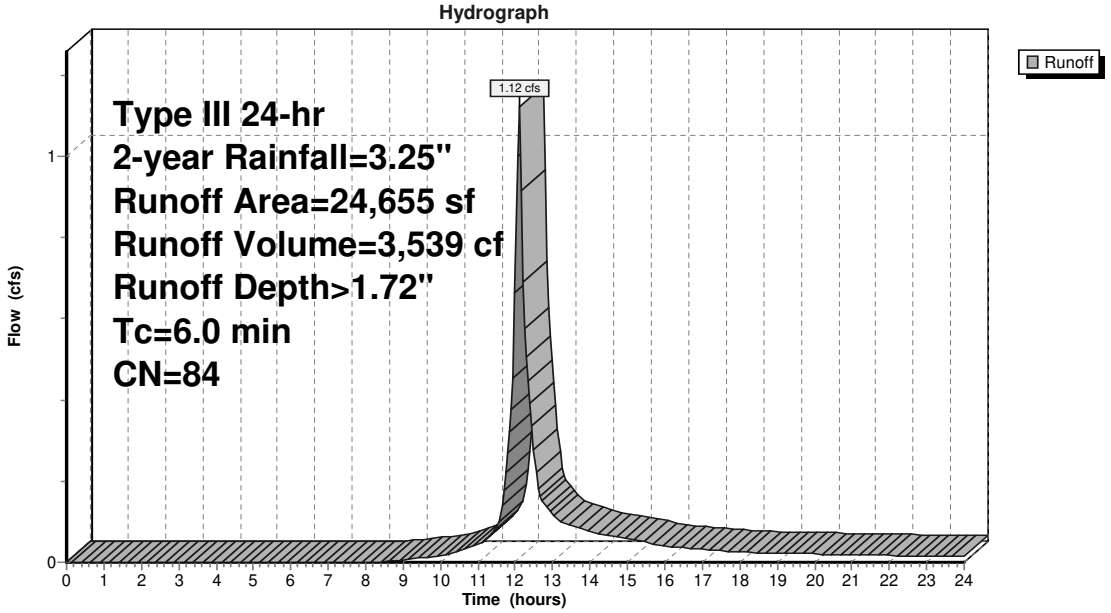
Runoff = 1.12 cfs @ 12.09 hrs, Volume= 3,539 cf, Depth> 1.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.25"

Area (sf)	CN	Description
7,702	98	Paved parking, HSG C
2,090	98	Roofs, HSG C
14,863	74	>75% Grass cover, Good, HSG C
24,655	84	Weighted Average
14,863		60.28% Pervious Area
9,792		39.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 4E: Pre Dev

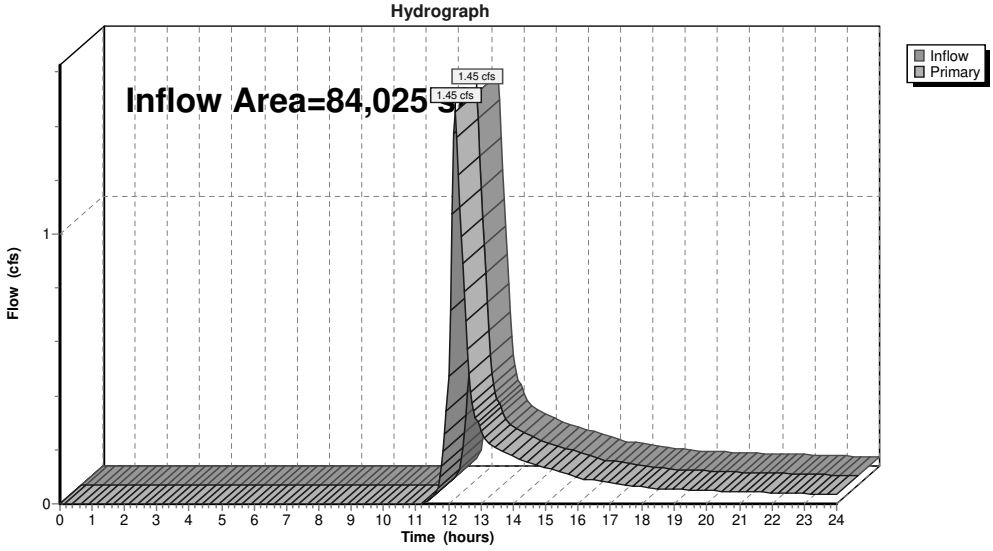


Summary for Link 1L: 1L

Inflow Area = 84,025 sf, 0.77% Impervious, Inflow Depth > 0.89" for 2-year event
Inflow = 1.45 cfs @ 12.20 hrs, Volume= 6,264 cf
Primary = 1.45 cfs @ 12.20 hrs, Volume= 6,264 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 1L: 1L



Summary for Subcatchment 1E: Pre-Dev

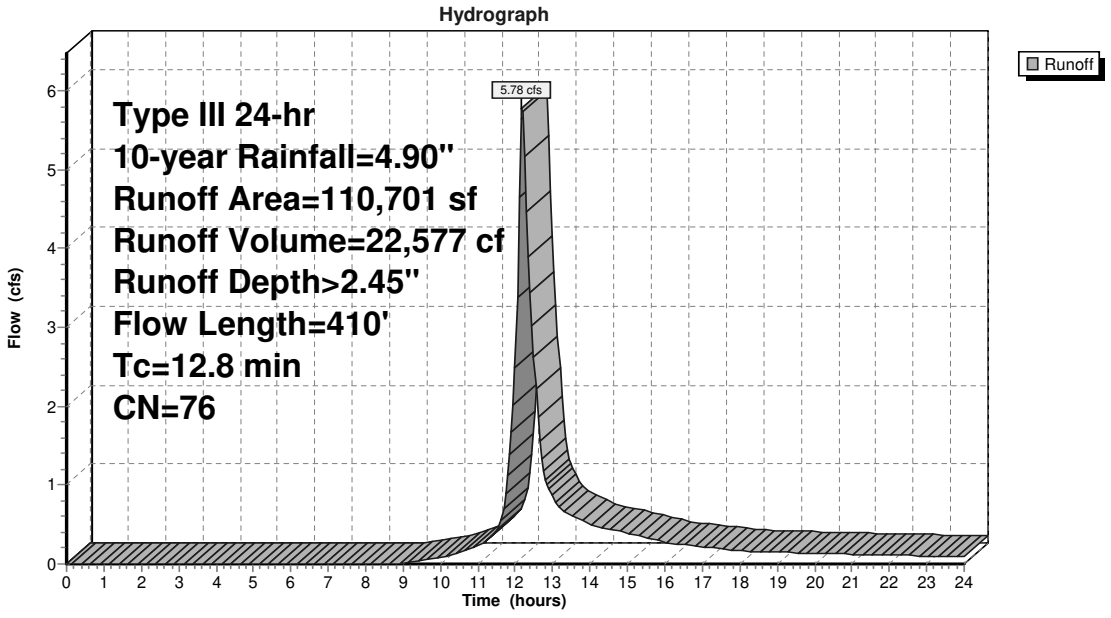
Runoff = 5.78 cfs @ 12.18 hrs, Volume= 22,577 cf, Depth> 2.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.90"

	Area (sf)	CN	Description
	10,228	98	Paved parking, HSG C
	5,535	98	Roofs, HSG C
	24,216	79	50-75% Grass cover, Fair, HSG C
	68,793	70	Woods, Good, HSG C
*	1,929	77	Welands,Woods, Good, HSG D
	110,701	76	Weighted Average
	94,938		85.76% Pervious Area
	15,763		14.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.3	40	0.0100	2.03		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
0.5	90	0.0400	3.22		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
3.8	230	0.0400	1.00		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
12.8	410	Total			

Subcatchment 1E: Pre-Dev



Summary for Subcatchment 2E: Pre Dev

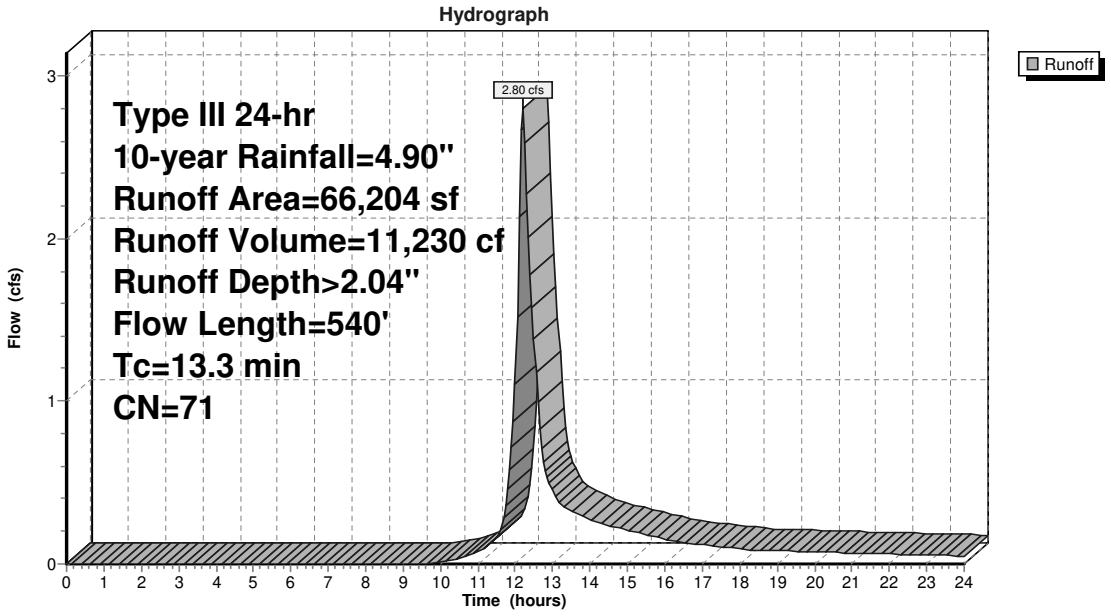
Runoff = 2.80 cfs @ 12.19 hrs, Volume= 11,230 cf, Depth> 2.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.90"

Area (sf)	CN	Description
645	98	Roofs, HSG C
13,669	74	>75% Grass cover, Good, HSG C
51,890	70	Woods, Good, HSG C
66,204	71	Weighted Average
65,559		99.03% Pervious Area
645		0.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.5	70	0.0200	2.28		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
4.1	260	0.0450	1.06		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
0.5	160	0.0170	5.83	34.97	**Channel Flow, D-E** Area= 6.0 sf Perim= 7.0' r= 0.86' n= 0.030 Earth, grassed & winding
13.3	540	Total			

Subcatchment 2E: Pre Dev



Summary for Subcatchment 3E: Pre Dev

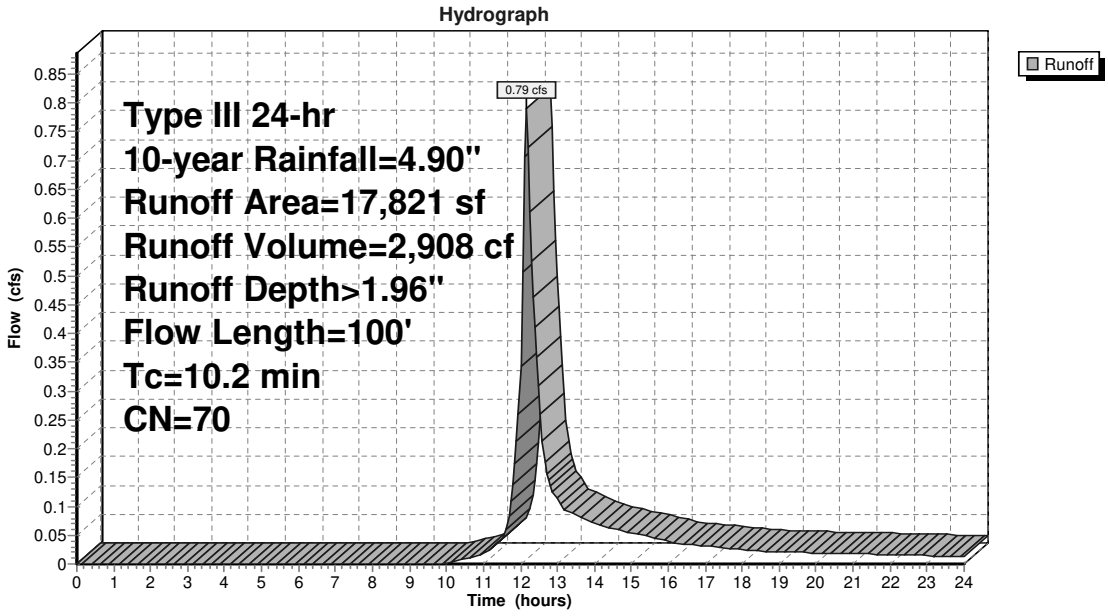
Runoff = 0.79 cfs @ 12.15 hrs, Volume= 2,908 cf, Depth> 1.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.90"

Area (sf)	CN	Description
17,821	70	Woods, Good, HSG C
17,821		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.9	50	0.0380	0.97		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
10.2	100	Total			

Subcatchment 3E: Pre Dev



Summary for Subcatchment 4E: Pre Dev

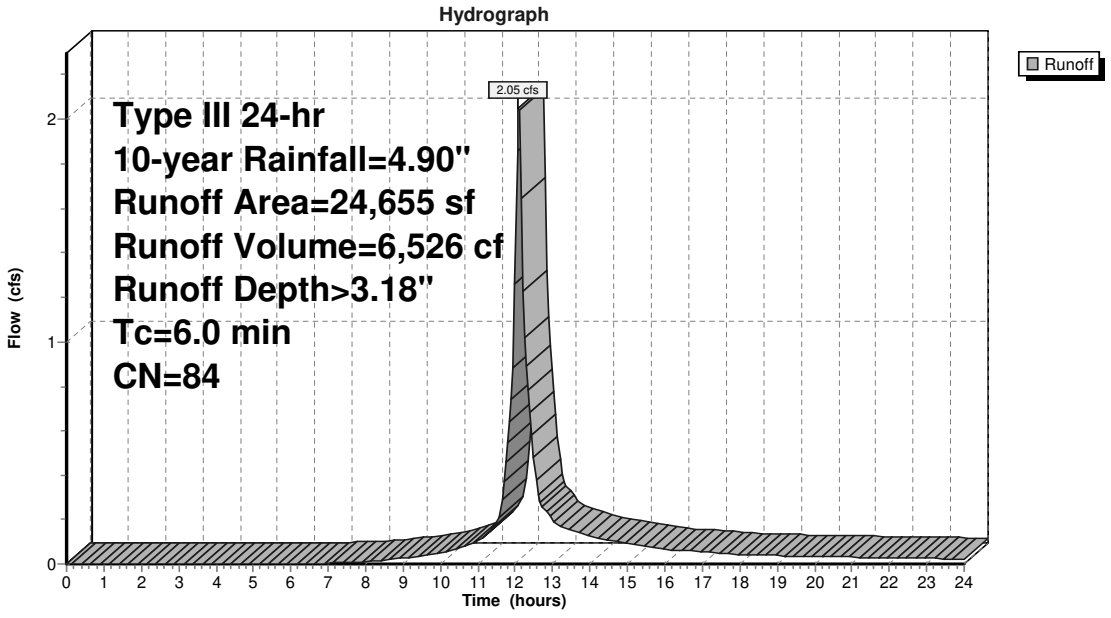
Runoff = 2.05 cfs @ 12.09 hrs, Volume= 6,526 cf, Depth> 3.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.90"

Area (sf)	CN	Description
7,702	98	Paved parking, HSG C
2,090	98	Roofs, HSG C
14,863	74	>75% Grass cover, Good, HSG C
24,655	84	Weighted Average
14,863		60.28% Pervious Area
9,792		39.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 4E: Pre Dev

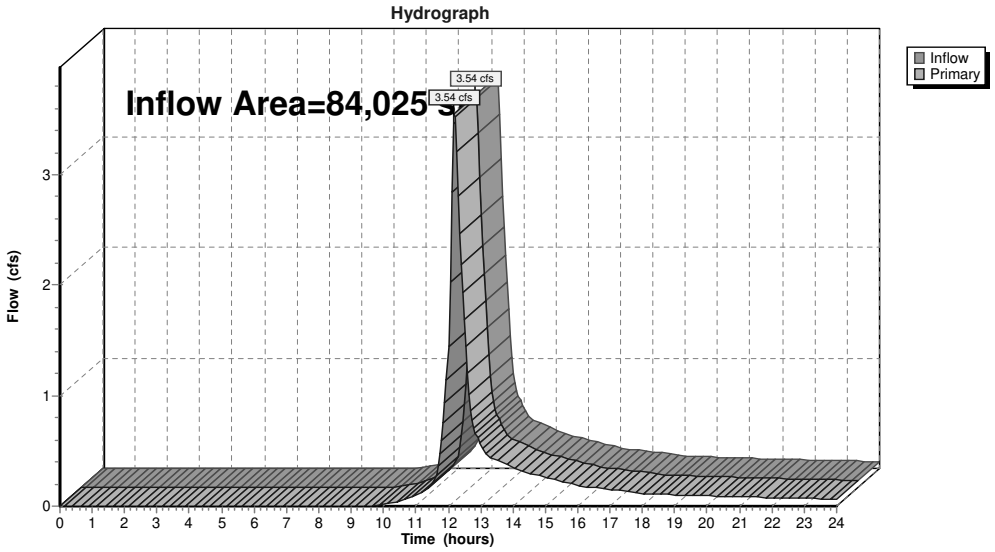


Summary for Link 1L: 1L

Inflow Area = 84,025 sf, 0.77% Impervious, Inflow Depth > 2.02" for 10-year event
Inflow = 3.54 cfs @ 12.18 hrs, Volume= 14,138 cf
Primary = 3.54 cfs @ 12.18 hrs, Volume= 14,138 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 1L: 1L



Summary for Subcatchment 1E: Pre-Dev

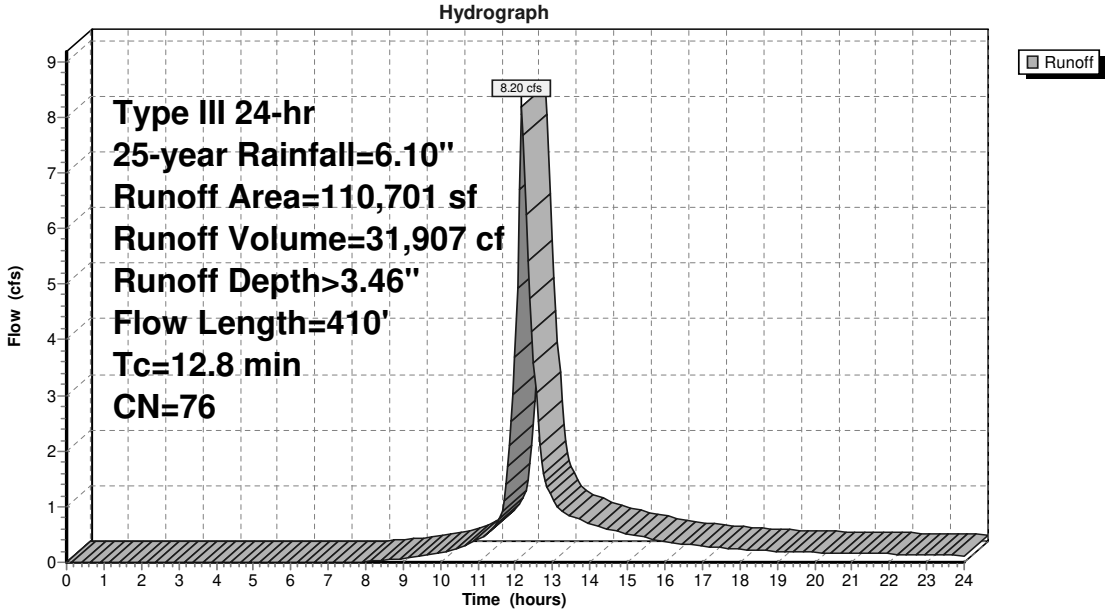
Runoff = 8.20 cfs @ 12.18 hrs, Volume= 31,907 cf, Depth> 3.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.10"

	Area (sf)	CN	Description
	10,228	98	Paved parking, HSG C
	5,535	98	Roofs, HSG C
	24,216	79	50-75% Grass cover, Fair, HSG C
	68,793	70	Woods, Good, HSG C
*	1,929	77	Welands,Woods, Good, HSG D
	110,701	76	Weighted Average
	94,938		85.76% Pervious Area
	15,763		14.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.3	40	0.0100	2.03		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
0.5	90	0.0400	3.22		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
3.8	230	0.0400	1.00		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
12.8	410	Total			

Subcatchment 1E: Pre-Dev



Summary for Subcatchment 2E: Pre Dev

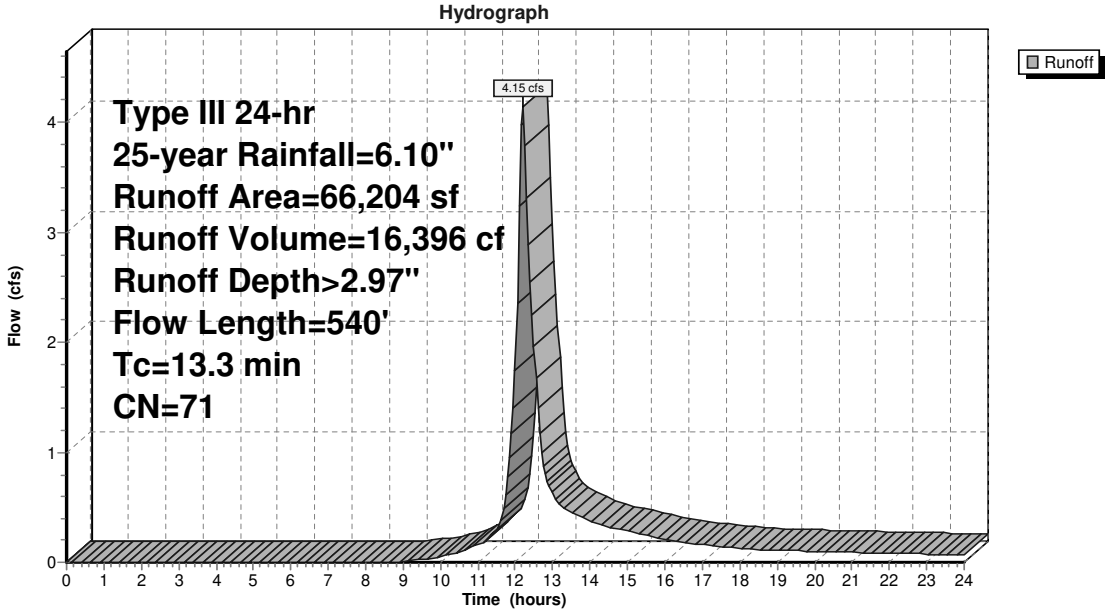
Runoff = 4.15 cfs @ 12.19 hrs, Volume= 16,396 cf, Depth> 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.10"

Area (sf)	CN	Description
645	98	Roofs, HSG C
13,669	74	>75% Grass cover, Good, HSG C
51,890	70	Woods, Good, HSG C
66,204	71	Weighted Average
65,559		99.03% Pervious Area
645		0.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.5	70	0.0200	2.28		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
4.1	260	0.0450	1.06		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
0.5	160	0.0170	5.83	34.97	**Channel Flow, D-E** Area= 6.0 sf Perim= 7.0' r= 0.86' n= 0.030 Earth, grassed & winding
13.3	540	Total			

Subcatchment 2E: Pre Dev



Summary for Subcatchment 3E: Pre Dev

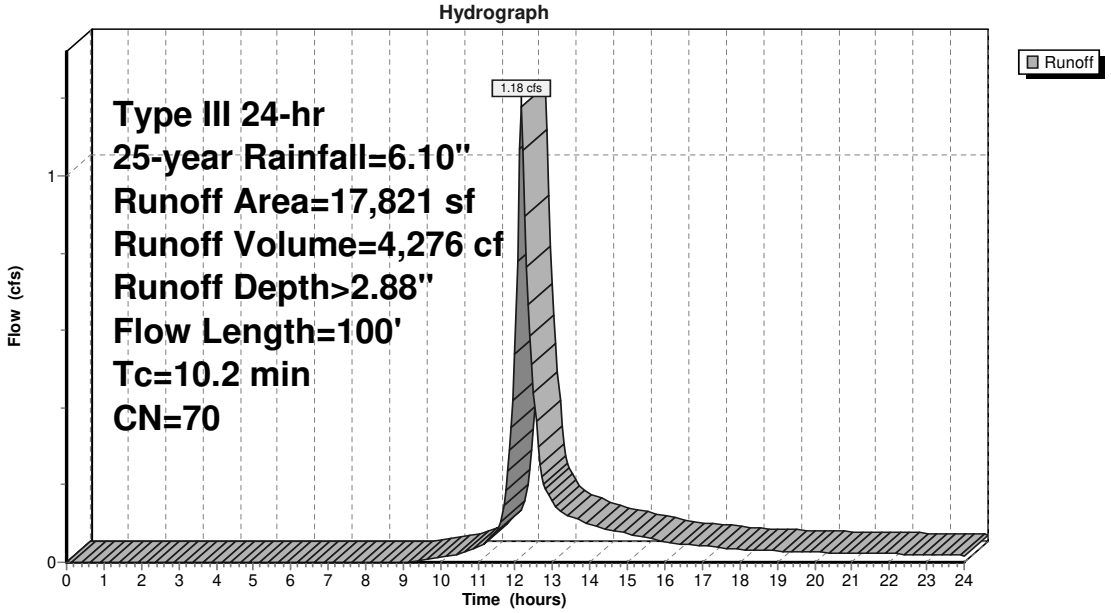
Runoff = 1.18 cfs @ 12.15 hrs, Volume= 4,276 cf, Depth> 2.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.10"

Area (sf)	CN	Description
17,821	70	Woods, Good, HSG C
17,821		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.9	50	0.0380	0.97		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
10.2	100	Total			

Subcatchment 3E: Pre Dev



Summary for Subcatchment 4E: Pre Dev

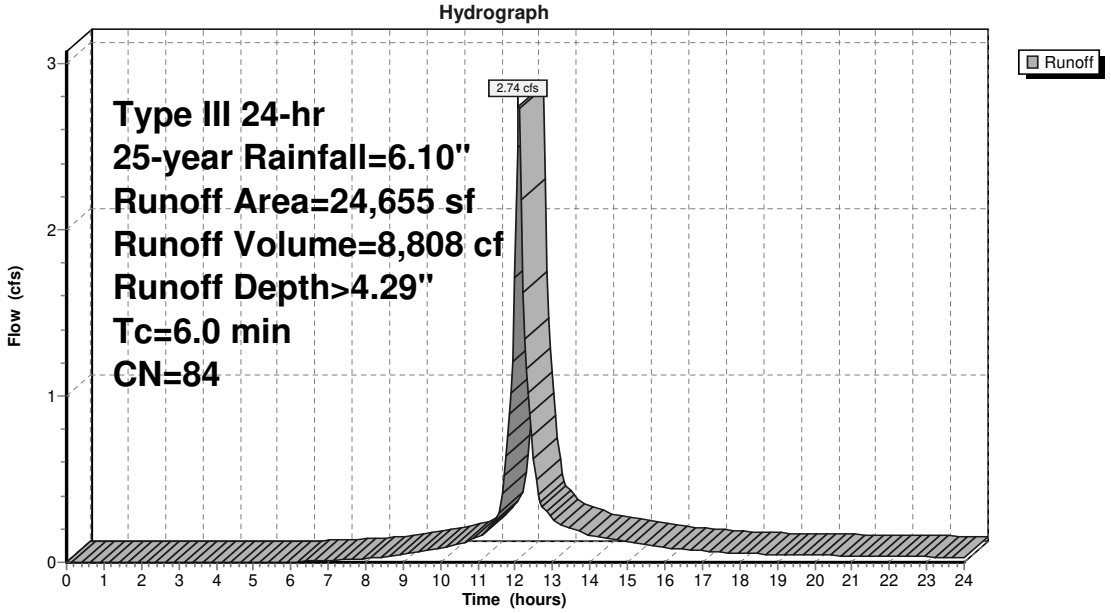
Runoff = 2.74 cfs @ 12.09 hrs, Volume= 8,808 cf, Depth> 4.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.10"

Area (sf)	CN	Description
7,702	98	Paved parking, HSG C
2,090	98	Roofs, HSG C
14,863	74	>75% Grass cover, Good, HSG C
24,655	84	Weighted Average
14,863		60.28% Pervious Area
9,792		39.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 4E: Pre Dev

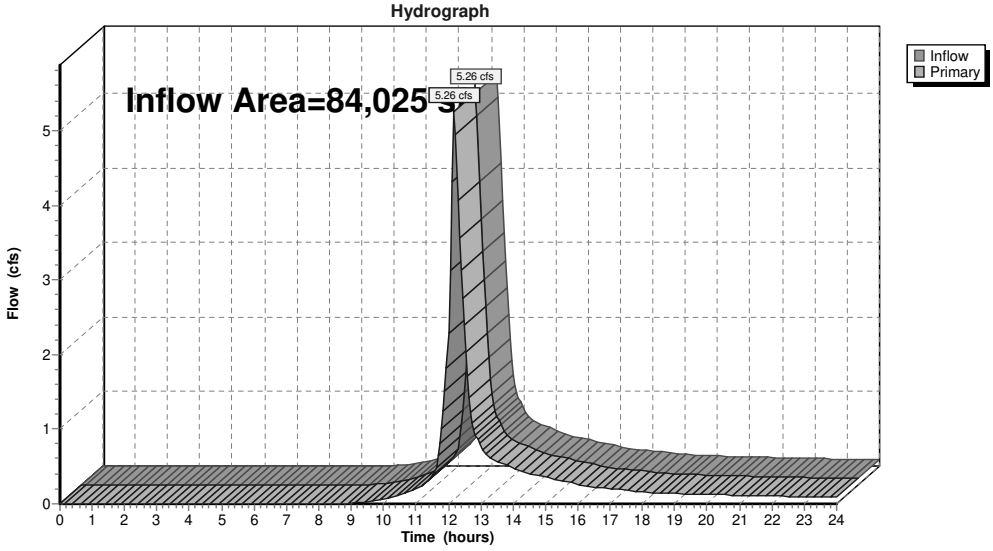


Summary for Link 1L: 1L

Inflow Area = 84,025 sf, 0.77% Impervious, Inflow Depth > 2.95" for 25-year event
Inflow = 5.26 cfs @ 12.18 hrs, Volume= 20,671 cf
Primary = 5.26 cfs @ 12.18 hrs, Volume= 20,671 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 1L: 1L



Summary for Subcatchment 1E: Pre-Dev

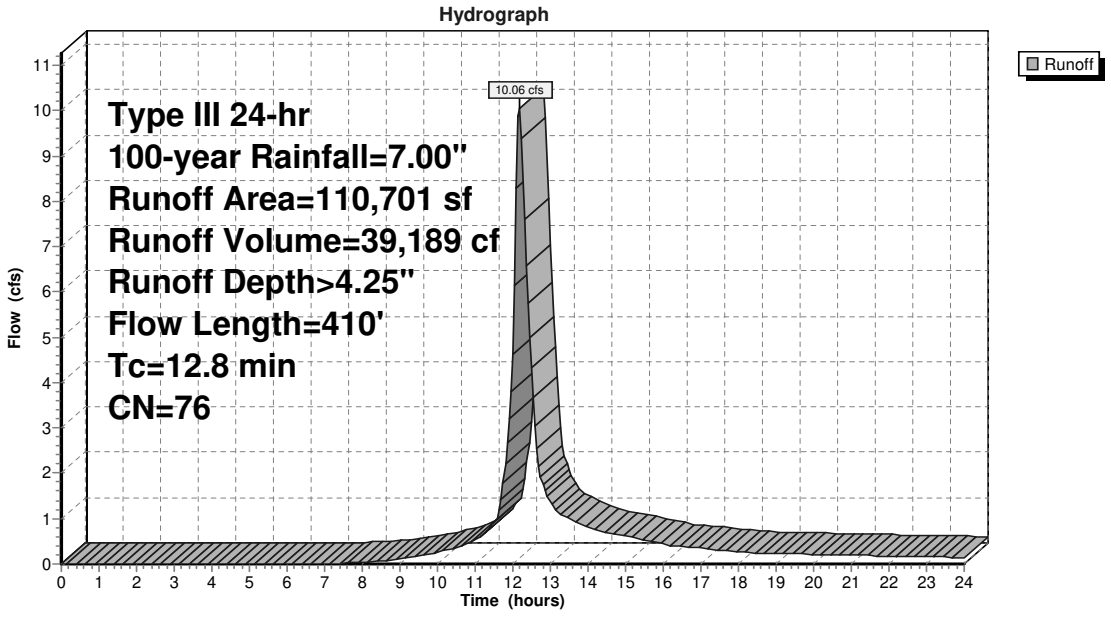
Runoff = 10.06 cfs @ 12.18 hrs, Volume= 39,189 cf, Depth> 4.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.00"

	Area (sf)	CN	Description
	10,228	98	Paved parking, HSG C
	5,535	98	Roofs, HSG C
	24,216	79	50-75% Grass cover, Fair, HSG C
	68,793	70	Woods, Good, HSG C
*	1,929	77	Welands,Woods, Good, HSG D
	110,701	76	Weighted Average
	94,938		85.76% Pervious Area
	15,763		14.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.3	40	0.0100	2.03		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
0.5	90	0.0400	3.22		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
3.8	230	0.0400	1.00		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
12.8	410	Total			

Subcatchment 1E: Pre-Dev



Summary for Subcatchment 2E: Pre Dev

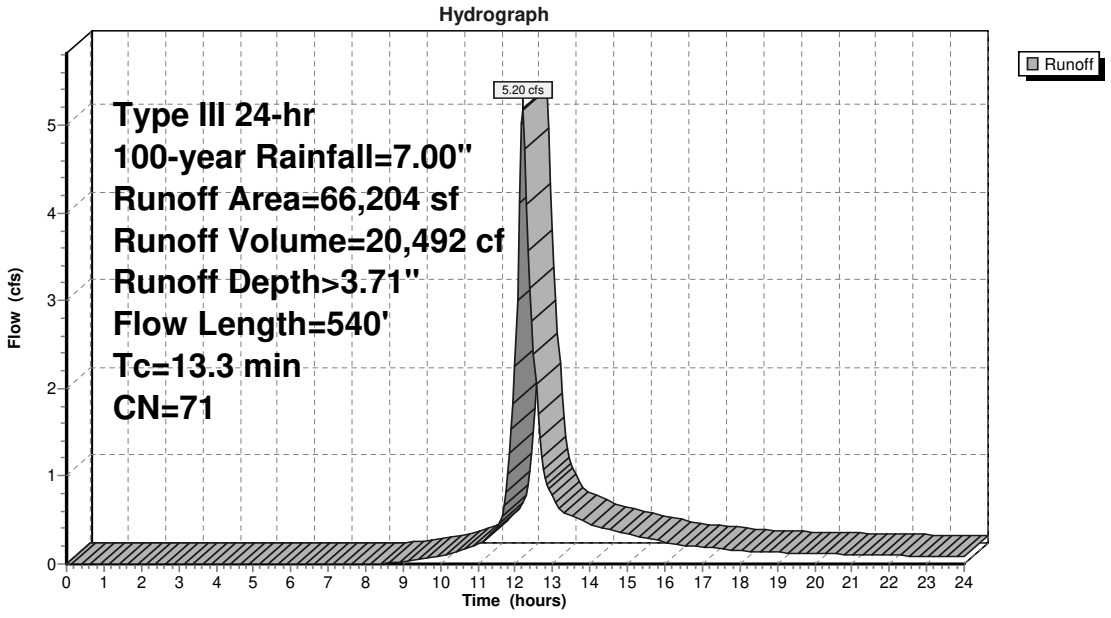
Runoff = 5.20 cfs @ 12.19 hrs, Volume= 20,492 cf, Depth> 3.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.00"

Area (sf)	CN	Description
645	98	Roofs, HSG C
13,669	74	>75% Grass cover, Good, HSG C
51,890	70	Woods, Good, HSG C
66,204	71	Weighted Average
65,559		99.03% Pervious Area
645		0.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.5	70	0.0200	2.28		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
4.1	260	0.0450	1.06		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
0.5	160	0.0170	5.83	34.97	**Channel Flow, D-E** Area= 6.0 sf Perim= 7.0' r= 0.86' n= 0.030 Earth, grassed & winding
13.3	540	Total			

Subcatchment 2E: Pre Dev



Summary for Subcatchment 3E: Pre Dev

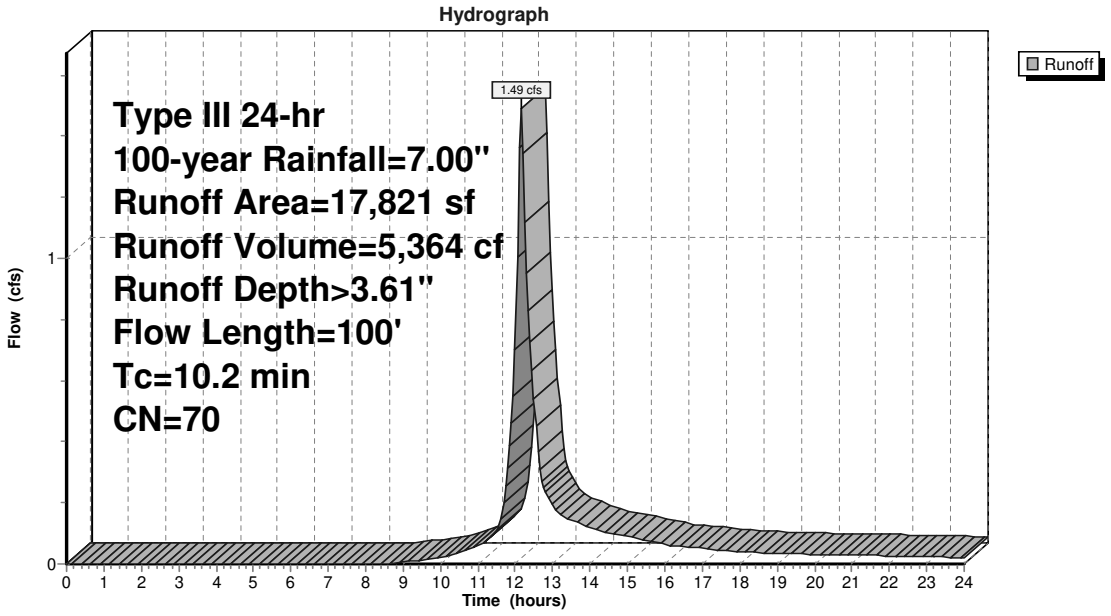
Runoff = 1.49 cfs @ 12.15 hrs, Volume= 5,364 cf, Depth> 3.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.00"

Area (sf)	CN	Description
17,821	70	Woods, Good, HSG C
17,821		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.9	50	0.0380	0.97		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
10.2	100	Total			

Subcatchment 3E: Pre Dev



Summary for Subcatchment 4E: Pre Dev

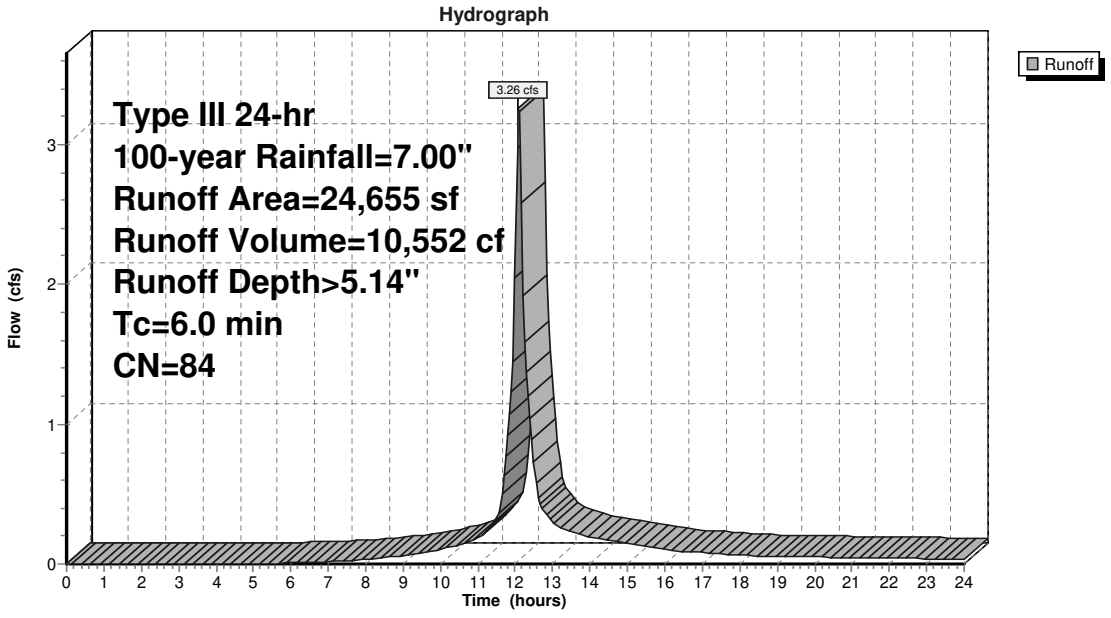
Runoff = 3.26 cfs @ 12.09 hrs, Volume= 10,552 cf, Depth> 5.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.00"

Area (sf)	CN	Description
7,702	98	Paved parking, HSG C
2,090	98	Roofs, HSG C
14,863	74	>75% Grass cover, Good, HSG C
24,655	84	Weighted Average
14,863		60.28% Pervious Area
9,792		39.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 4E: Pre Dev

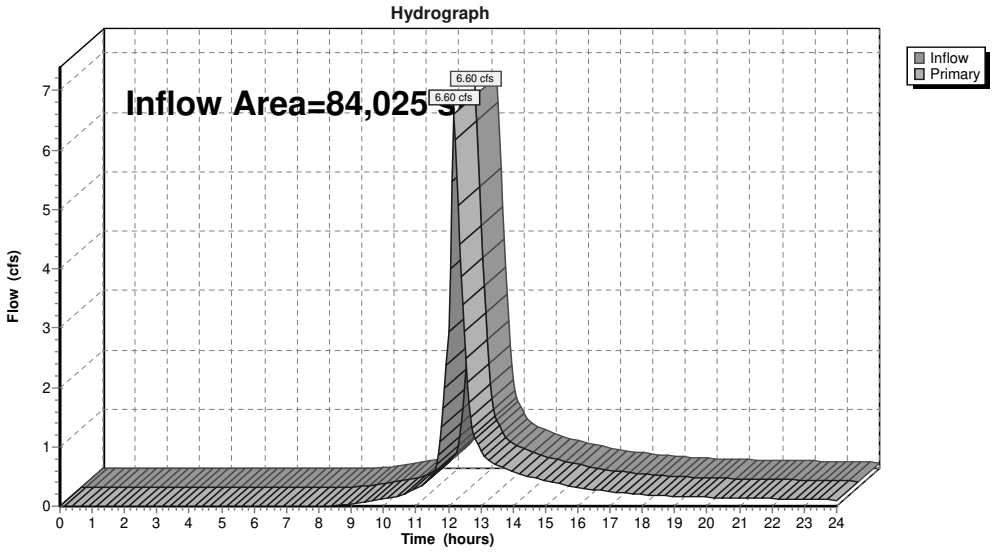


Summary for Link 1L: 1L

Inflow Area = 84,025 sf, 0.77% Impervious, Inflow Depth > 3.69" for 100-year event
Inflow = 6.60 cfs @ 12.18 hrs, Volume= 25,855 cf
Primary = 6.60 cfs @ 12.18 hrs, Volume= 25,855 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

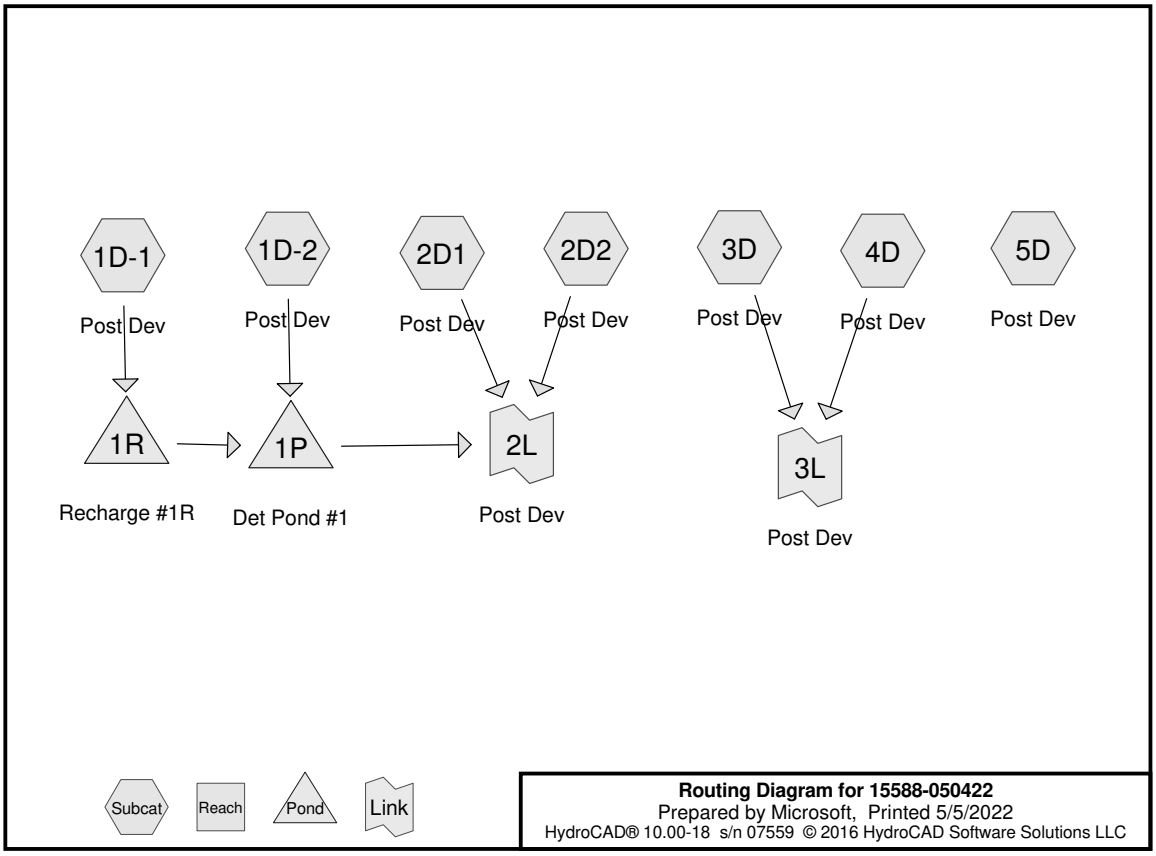
Link 1L: 1L



APPENDIX – A2

Calculations for Post Development

Standard 2:



Summary for Subcatchment 1D-1: Post Dev

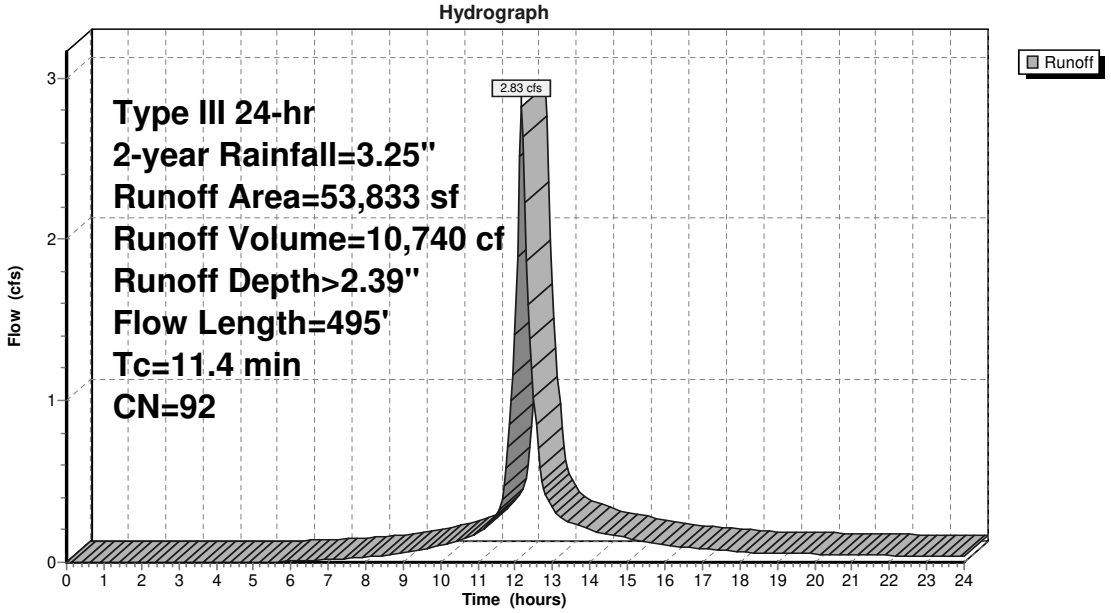
Runoff = 2.83 cfs @ 12.16 hrs, Volume= 10,740 cf, Depth> 2.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.25"

	Area (sf)	CN	Description
	18,252	98	Roofs, HSG C
*	6,650	98	Paved Drives, HSG C
*	14,724	98	Paved roads, HSG C
	14,207	74	>75% Grass cover, Good, HSG C
	53,833	92	Weighted Average
	14,207		26.39% Pervious Area
	39,626		73.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.3	40	0.0100	2.03		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
1.5	115	0.0060	1.25		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
0.5	65	0.0100	2.03		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
0.9	225	0.0090	4.30	3.38	**Pipe Channel, E-F** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
11.4	495	Total			

Subcatchment 1D-1: Post Dev



Summary for Subcatchment 1D-2: Post Dev

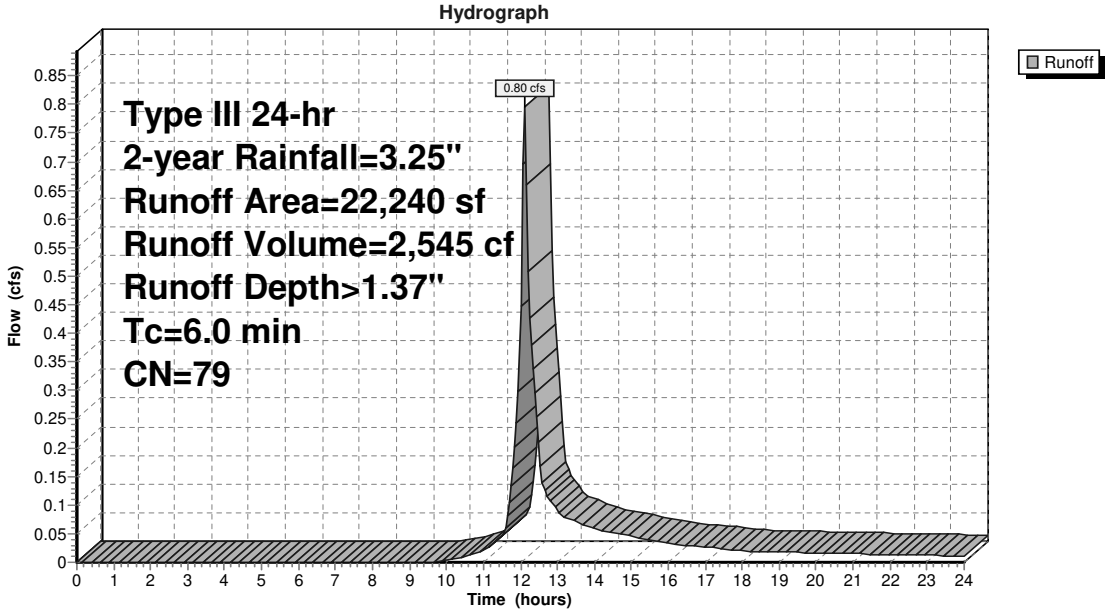
Runoff = 0.80 cfs @ 12.10 hrs, Volume= 2,545 cf, Depth> 1.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.25"

	Area (sf)	CN	Description
	17,385	74	>75% Grass cover, Good, HSG C
*	4,855	98	Drain Basin
	22,240	79	Weighted Average
	17,385		78.17% Pervious Area
	4,855		21.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 1D-2: Post Dev



Summary for Subcatchment 2D1: Post Dev

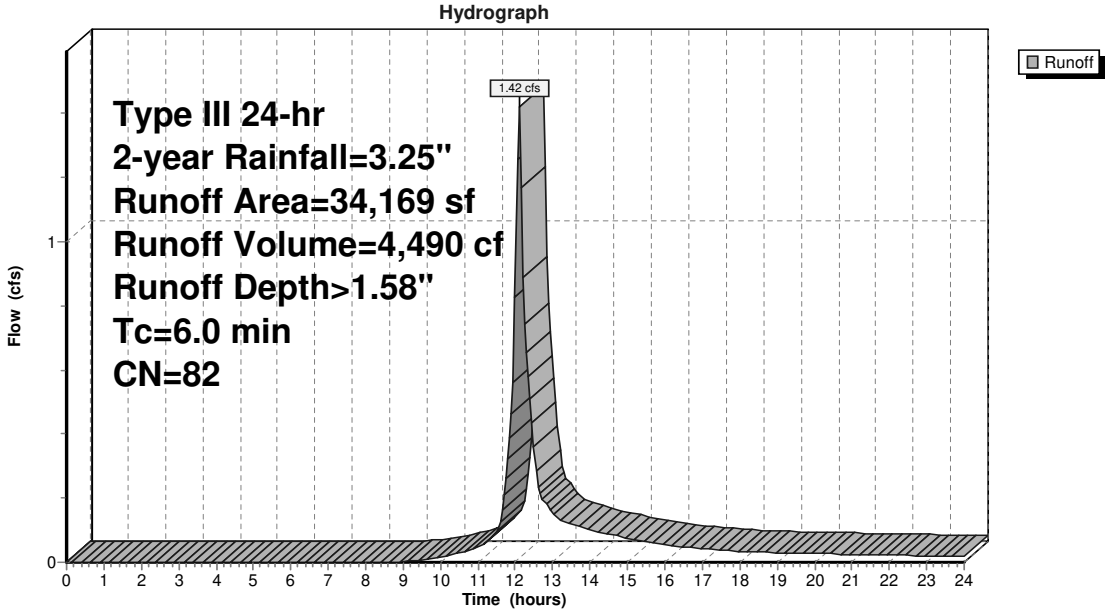
Runoff = 1.42 cfs @ 12.09 hrs, Volume= 4,490 cf, Depth> 1.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.25"

	Area (sf)	CN	Description
*	9,511	98	Paved, HSG C
*	1,265	98	Roof, HSG C
	21,464	74	>75% Grass cover, Good, HSG C
*	1,929	77	Wetlands, Woods, Good, HSG D
	34,169	82	Weighted Average
	23,393		68.46% Pervious Area
	10,776		31.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 2D1: Post Dev



Summary for Subcatchment 2D2: Post Dev

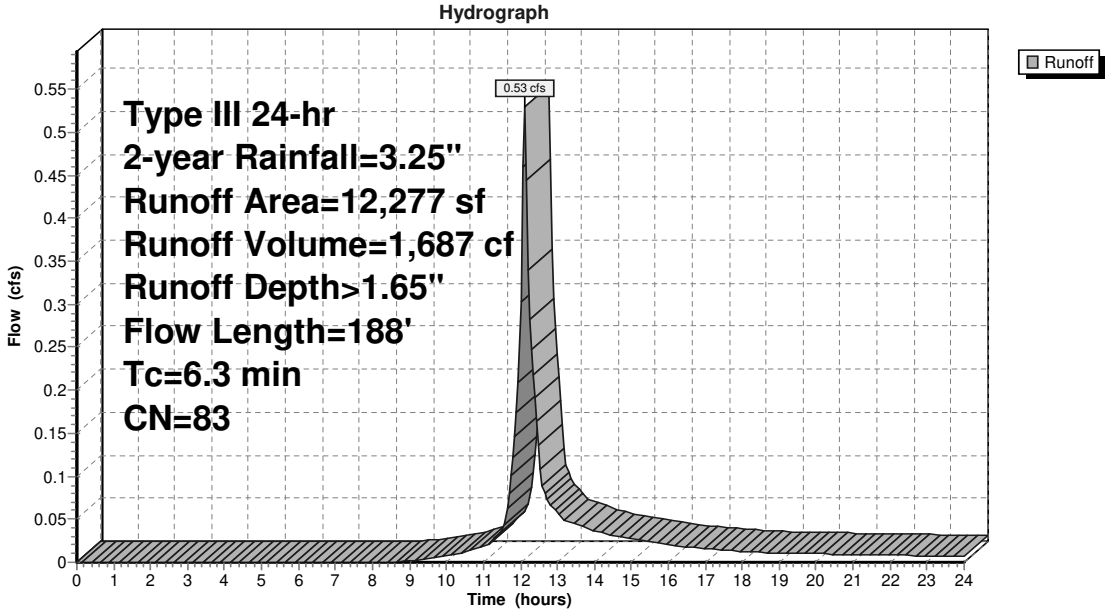
Runoff = 0.53 cfs @ 12.10 hrs, Volume= 1,687 cf, Depth> 1.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.25"

	Area (sf)	CN	Description
*	1,912	98	Paved road, HSG C
*	1,421	98	Drives, HSG C
	1,254	98	Roofs, HSG C
	7,690	74	>75% Grass cover, Good, HSG C
	12,277	83	Weighted Average
	7,690		62.64% Pervious Area
	4,587		37.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	28	0.0600	0.09		**Sheet Flow, A-b** Grass: Bermuda n= 0.410 P2= 3.20"
0.7	85	0.0100	2.03		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
0.5	75	0.0050	2.62	15.69	**Channel Flow, C-D** Area= 6.0 sf Perim= 9.3' r= 0.65' n= 0.030 Earth, grassed & winding
6.3	188	Total			

Subcatchment 2D2: Post Dev



Summary for Subcatchment 3D: Post Dev

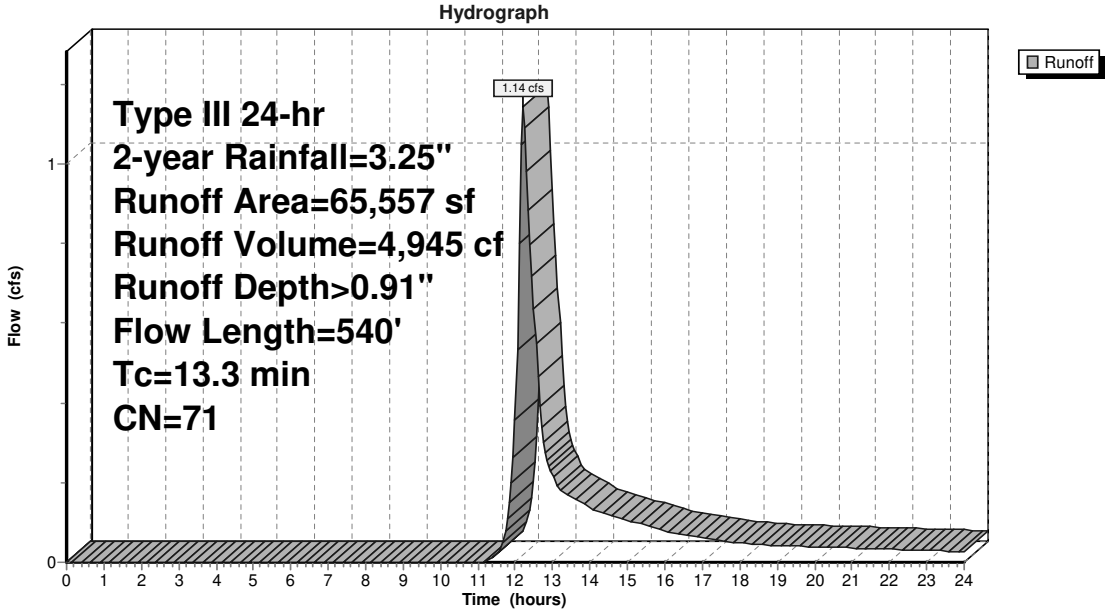
Runoff = 1.14 cfs @ 12.21 hrs, Volume= 4,945 cf, Depth> 0.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.25"

Area (sf)	CN	Description
11,685	74	>75% Grass cover, Good, HSG C
52,113	70	Woods, Good, HSG C
1,759	98	Roofs, HSG C
65,557	71	Weighted Average
63,798		97.32% Pervious Area
1,759		2.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.5	70	0.0200	2.28		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
4.1	260	0.0450	1.06		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
0.5	160	0.0170	5.83	34.97	**Channel Flow, D-E** Area= 6.0 sf Perim= 7.0' r= 0.86' n= 0.030
13.3	540	Total			

Subcatchment 3D: Post Dev



Summary for Subcatchment 4D: Post Dev

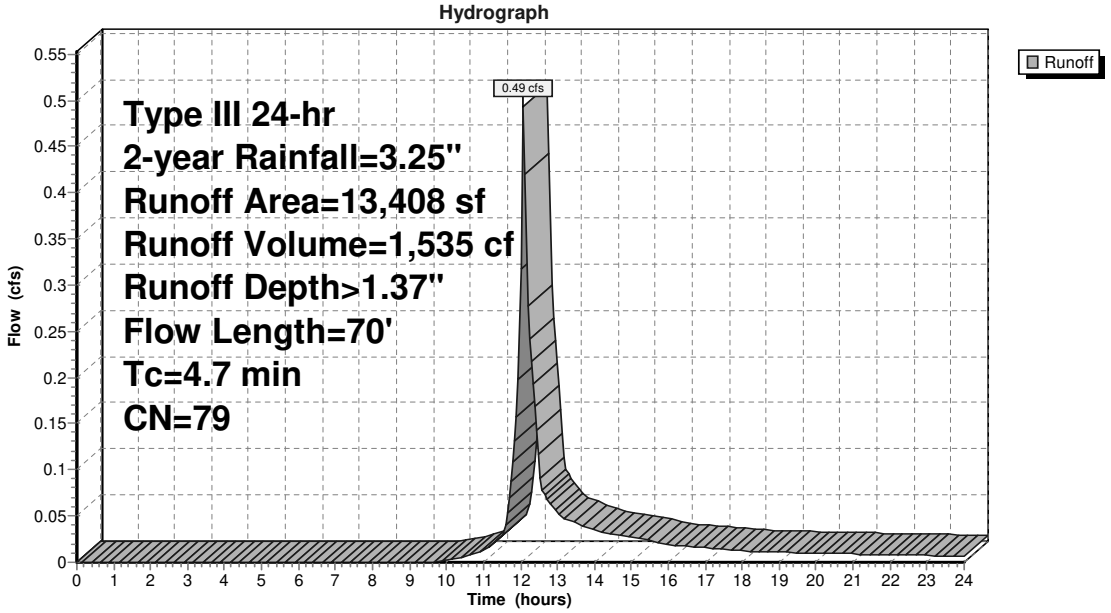
Runoff = 0.49 cfs @ 12.08 hrs, Volume= 1,535 cf, Depth> 1.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.25"

Area (sf)	CN	Description
3,474	98	Roofs, HSG C
4,913	70	Woods, Good, HSG C
5,021	74	>75% Grass cover, Good, HSG C
13,408	79	Weighted Average
9,934		74.09% Pervious Area
3,474		25.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	35	0.0450	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.2	35	0.0400	3.22		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
4.7	70	Total			

Subcatchment 4D: Post Dev



Summary for Subcatchment 5D: Post Dev

Runoff = 0.91 cfs @ 12.09 hrs, Volume= 2,866 cf, Depth> 1.80"

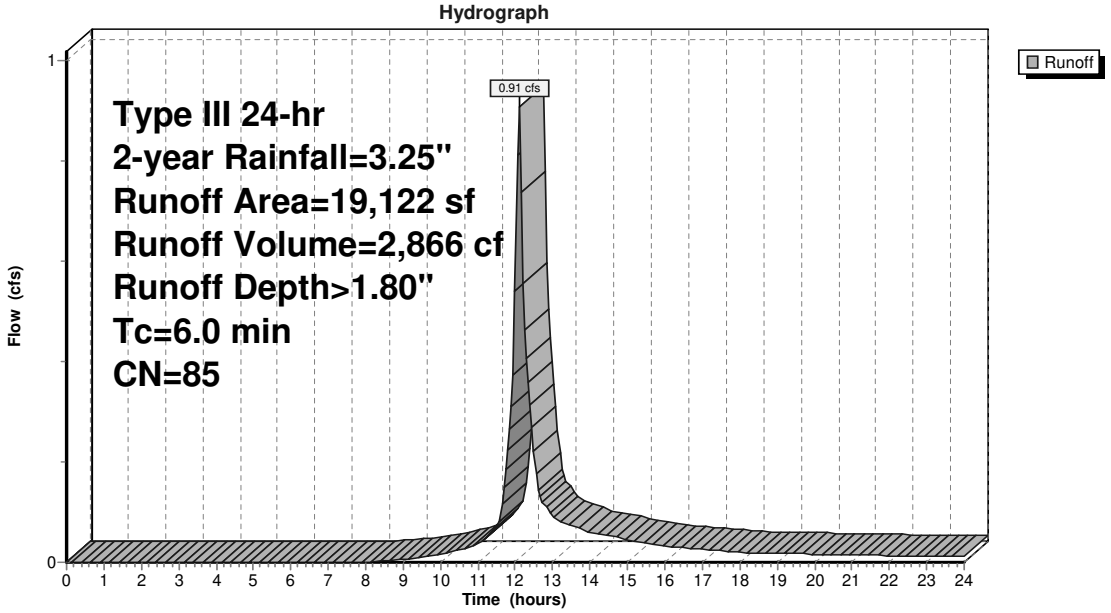
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.25"

Area (sf)	CN	Description
2,340	98	Paved parking, HSG C
4,998	98	Paved roads w/curbs & sewers, HSG C
1,212	98	Roofs, HSG C
10,572	74	>75% Grass cover, Good, HSG C
19,122	85	Weighted Average
10,572		55.29% Pervious Area
8,550		44.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 5D: Post Dev

Hydrograph



Summary for Pond 1P: Det Pond #1

Inflow Area = 76,073 sf, 58.47% Impervious, Inflow Depth > 1.63" for 2-year event
Inflow = 3.07 cfs @ 12.19 hrs, Volume= 10,308 cf
Outflow = 0.26 cfs @ 13.88 hrs, Volume= 6,326 cf, Atten= 91%, Lag= 101.3 min
Primary = 0.26 cfs @ 13.88 hrs, Volume= 6,326 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 110.06' @ 13.88 hrs Surf.Area= 5,356 sf Storage= 6,069 cf

Plug-Flow detention time= 297.4 min calculated for 6,326 cf (61% of inflow)
Center-of-Mass det. time= 206.9 min (1,036.0 - 829.1)

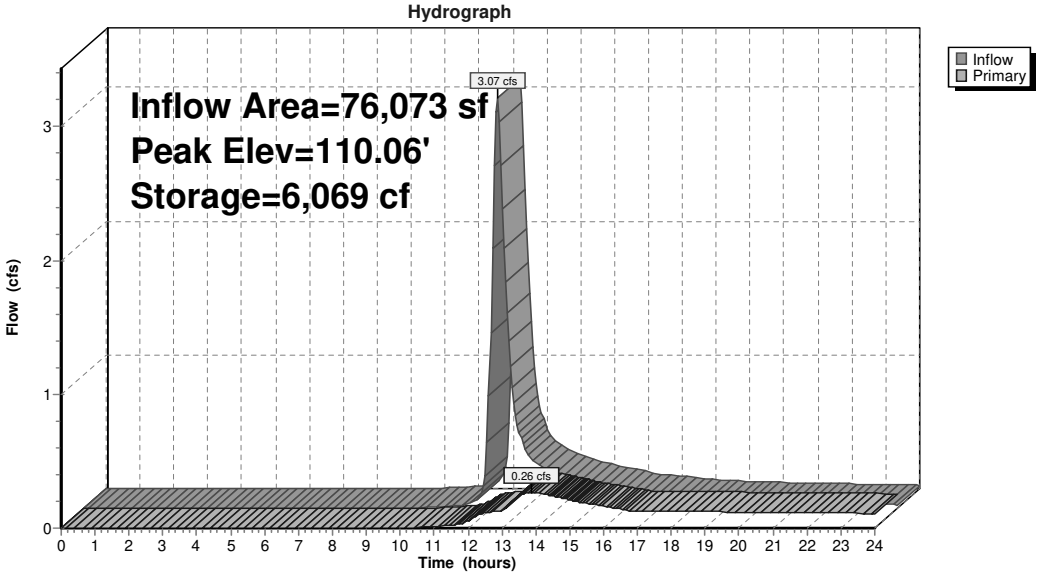
Volume	Invert	Avail.Storage	Storage Description
#1	108.50'	18,291 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
108.50	50	100.0	0	0	50
108.70	1,481	179.0	120	120	1,804
109.00	4,281	337.0	828	948	8,292
110.00	5,295	393.0	4,779	5,727	11,566
111.00	6,286	403.0	5,783	11,511	12,314
112.00	7,287	415.0	6,780	18,291	13,196

Device	Routing	Invert	Outlet Devices
#1	Primary	108.50'	**18.0" Round Culvert** L= 20.0' Ke= 0.500 Inlet / Outlet Invert= 108.50' / 108.00' S= 0.0250 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	108.50'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	111.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	110.00'	**2.5' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.0' Crest Height

Primary OutFlow Max=0.26 cfs @ 13.88 hrs HW=110.06' (Free Discharge)
└**1=Culvert** (Passes 0.26 cfs of 7.68 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.13 cfs @ 5.86 fps)
  ├**3=Orifice/Grate** (Controls 0.00 cfs)
  └**4=Sharp-Crested Rectangular Weir** (Weir Controls 0.13 cfs @ 0.84 fps)

Pond 1P: Det Pond #1



Summary for Pond 1R: Recharge #1R

Inflow Area = 53,833 sf, 73.61% Impervious, Inflow Depth > 2.39" for 2-year event
Inflow = 2.83 cfs @ 12.16 hrs, Volume= 10,740 cf
Outflow = 2.59 cfs @ 12.21 hrs, Volume= 9,071 cf, Atten= 8%, Lag= 3.3 min
Discarded = 0.02 cfs @ 7.60 hrs, Volume= 1,308 cf
Primary = 2.57 cfs @ 12.21 hrs, Volume= 7,763 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 111.70' @ 12.21 hrs Surf.Area= 1,731 sf Storage= 2,455 cf

Plug-Flow detention time= 101.0 min calculated for 9,071 cf (84% of inflow)
Center-of-Mass det. time= 36.4 min (837.6 - 801.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	109.50'	1,693 cf	**13.17'W x 131.50'L x 3.54'H Field A** 6,132 cf Overall - 1,900 cf Embedded = 4,232 cf x 40.0% Voids
#2A	110.00'	1,900 cf	**Cultec R-330XLHD** x 36 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 2 rows
		3,593 cf	Total Available Storage

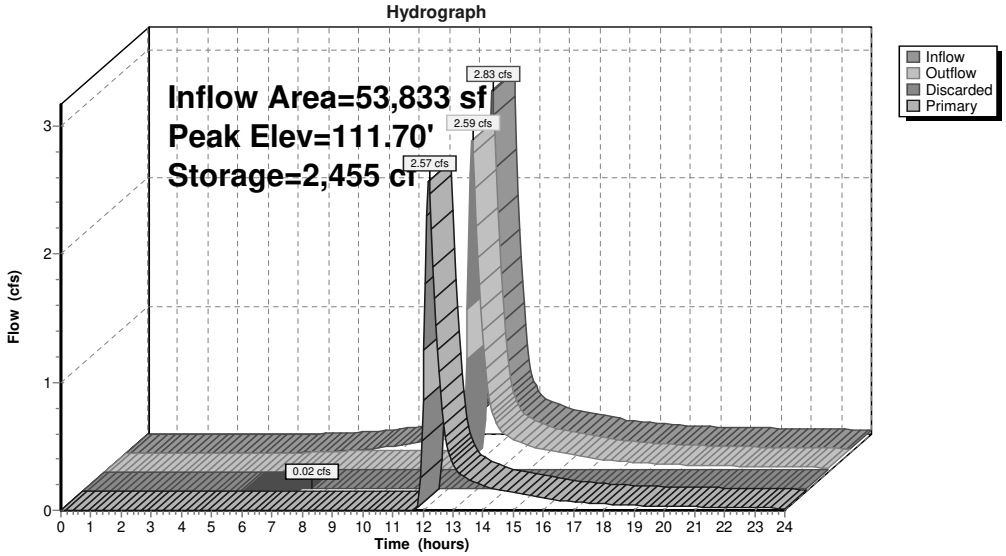
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	109.50'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	111.00'	**12.0" Round Culvert** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 111.00' / 110.90' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#3	Primary	111.00'	**12.0" Round Culvert** L= 10.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 111.00' / 110.90' S= 0.0100 '/' Cc= 0.900 n= 0.010, Flow Area= 0.79 sf

Discarded OutFlow Max=0.02 cfs @ 7.60 hrs HW=109.54' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=2.54 cfs @ 12.21 hrs HW=111.69' (Free Discharge)
├**2=Culvert** (Barrel Controls 1.20 cfs @ 2.91 fps)
└**3=Culvert** (Barrel Controls 1.34 cfs @ 3.24 fps)

Pond 1R: Recharge #1R

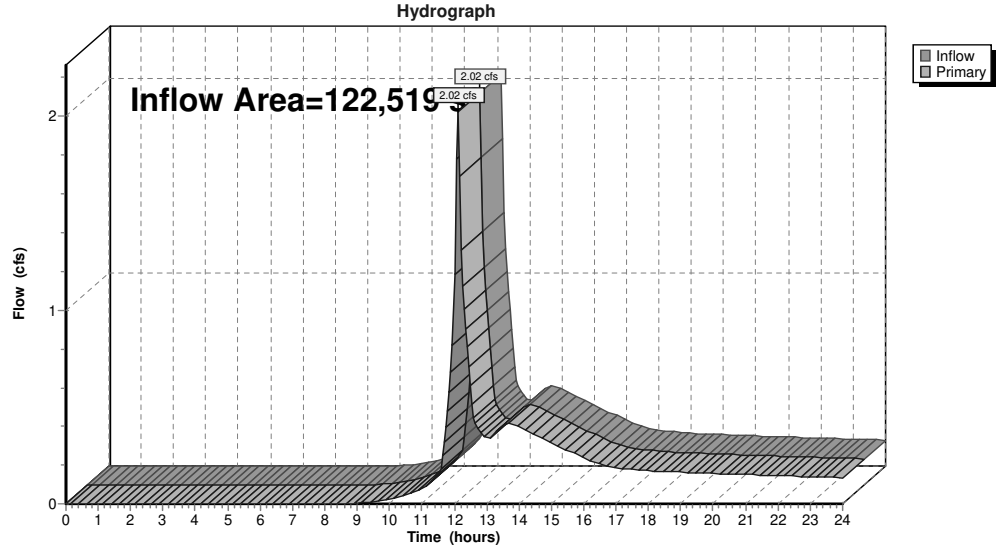


Summary for Link 2L: Post Dev

Inflow Area = 122,519 sf, 48.84% Impervious, Inflow Depth > 1.22" for 2-year event
Inflow = 2.02 cfs @ 12.10 hrs, Volume= 12,503 cf
Primary = 2.02 cfs @ 12.10 hrs, Volume= 12,503 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 2L: Post Dev

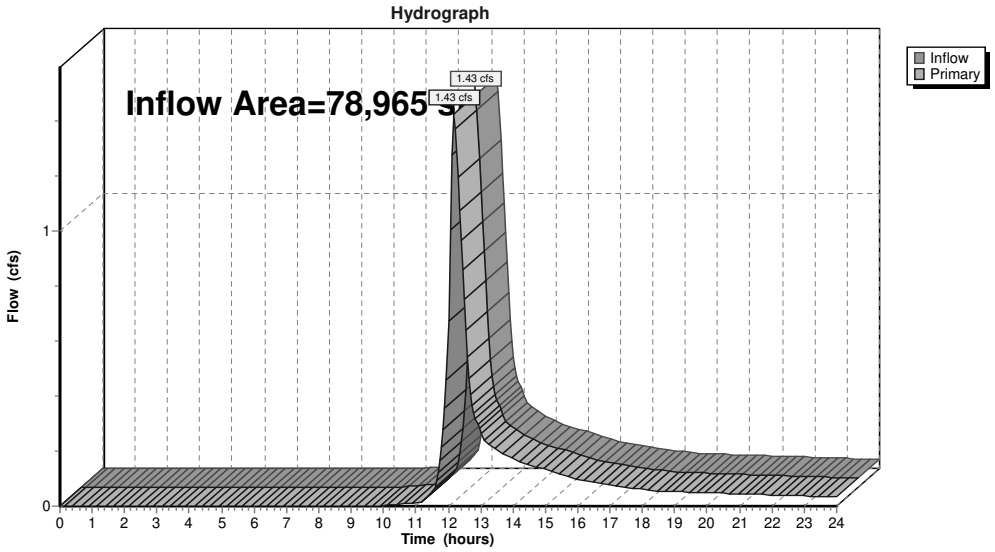


Summary for Link 3L: Post Dev

Inflow Area = 78,965 sf, 6.63% Impervious, Inflow Depth > 0.98" for 2-year event
Inflow = 1.43 cfs @ 12.18 hrs, Volume= 6,480 cf
Primary = 1.43 cfs @ 12.18 hrs, Volume= 6,480 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 3L: Post Dev



Summary for Subcatchment 1D-1: Post Dev

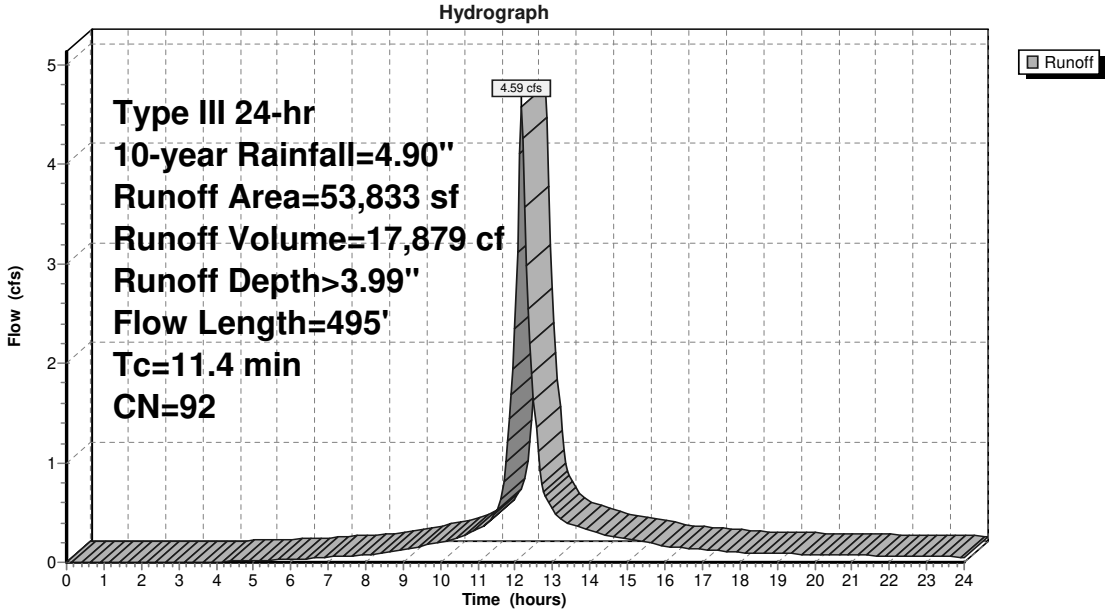
Runoff = 4.59 cfs @ 12.15 hrs, Volume= 17,879 cf, Depth> 3.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.90"

	Area (sf)	CN	Description
	18,252	98	Roofs, HSG C
*	6,650	98	Paved Drives, HSG C
*	14,724	98	Paved roads, HSG C
	14,207	74	>75% Grass cover, Good, HSG C
	53,833	92	Weighted Average
	14,207		26.39% Pervious Area
	39,626		73.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.3	40	0.0100	2.03		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
1.5	115	0.0060	1.25		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
0.5	65	0.0100	2.03		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
0.9	225	0.0090	4.30	3.38	**Pipe Channel, E-F** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
11.4	495	Total			

Subcatchment 1D-1: Post Dev



Summary for Subcatchment 1D-2: Post Dev

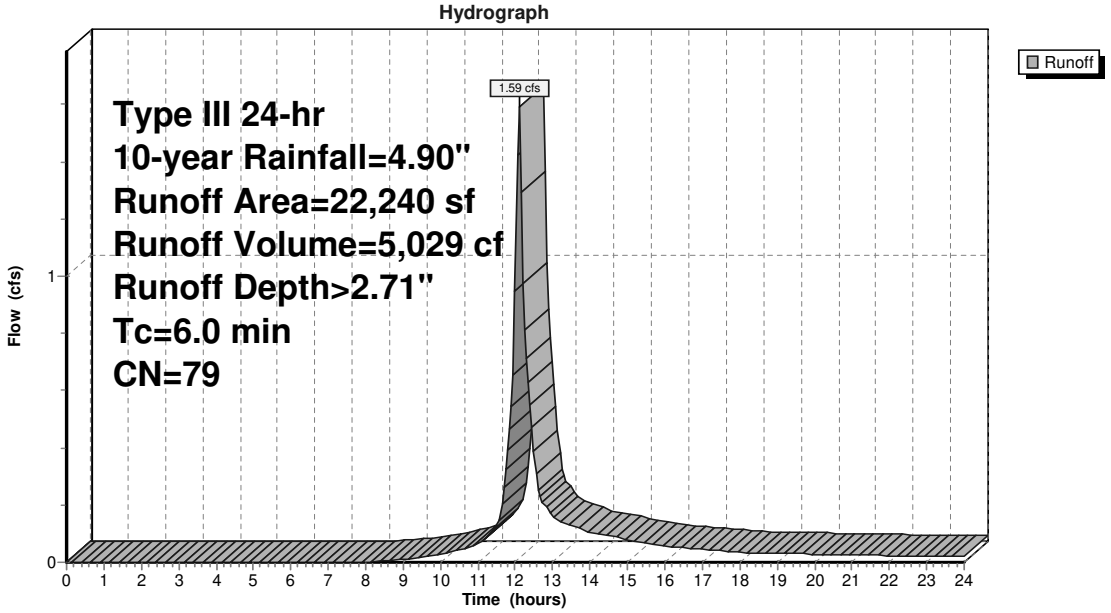
Runoff = 1.59 cfs @ 12.09 hrs, Volume= 5,029 cf, Depth> 2.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.90"

	Area (sf)	CN	Description
	17,385	74	>75% Grass cover, Good, HSG C
*	4,855	98	Drain Basin
	22,240	79	Weighted Average
	17,385		78.17% Pervious Area
	4,855		21.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 1D-2: Post Dev



Summary for Subcatchment 2D1: Post Dev

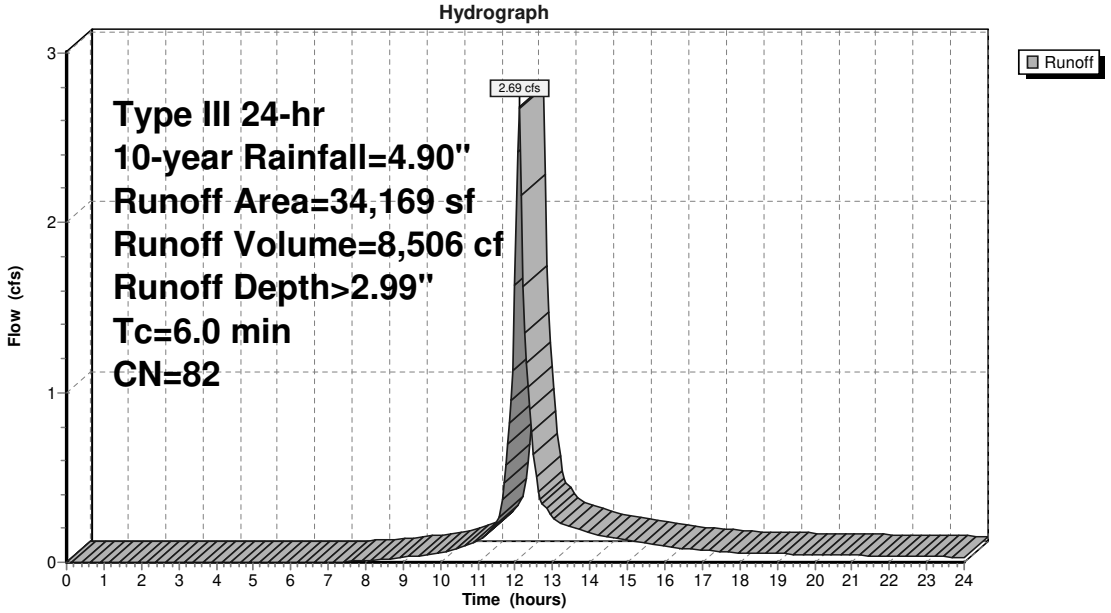
Runoff = 2.69 cfs @ 12.09 hrs, Volume= 8,506 cf, Depth> 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.90"

	Area (sf)	CN	Description
*	9,511	98	Paved, HSG C
*	1,265	98	Roof, HSG C
	21,464	74	>75% Grass cover, Good, HSG C
*	1,929	77	Wetlands, Woods, Good, HSG D
	34,169	82	Weighted Average
	23,393		68.46% Pervious Area
	10,776		31.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 2D1: Post Dev



Summary for Subcatchment 2D2: Post Dev

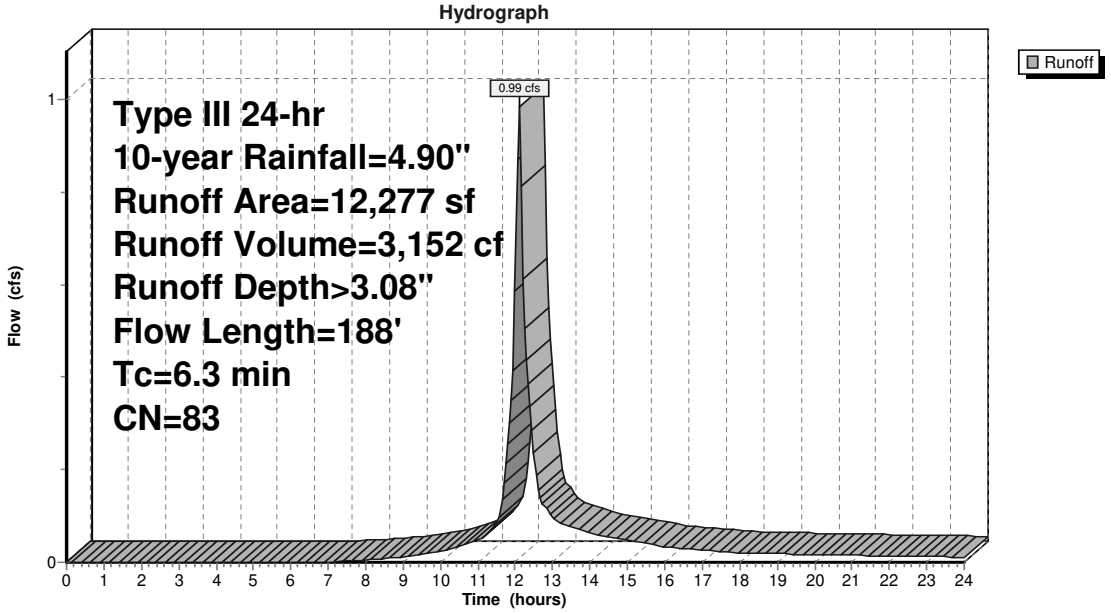
Runoff = 0.99 cfs @ 12.09 hrs, Volume= 3,152 cf, Depth> 3.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.90"

	Area (sf)	CN	Description
*	1,912	98	Paved road, HSG C
*	1,421	98	Drives, HSG C
	1,254	98	Roofs, HSG C
	7,690	74	>75% Grass cover, Good, HSG C
	12,277	83	Weighted Average
	7,690		62.64% Pervious Area
	4,587		37.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	28	0.0600	0.09		**Sheet Flow, A-b** Grass: Bermuda n= 0.410 P2= 3.20"
0.7	85	0.0100	2.03		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
0.5	75	0.0050	2.62	15.69	**Channel Flow, C-D** Area= 6.0 sf Perim= 9.3' r= 0.65' n= 0.030 Earth, grassed & winding
6.3	188	Total			

Subcatchment 2D2: Post Dev



Summary for Subcatchment 3D: Post Dev

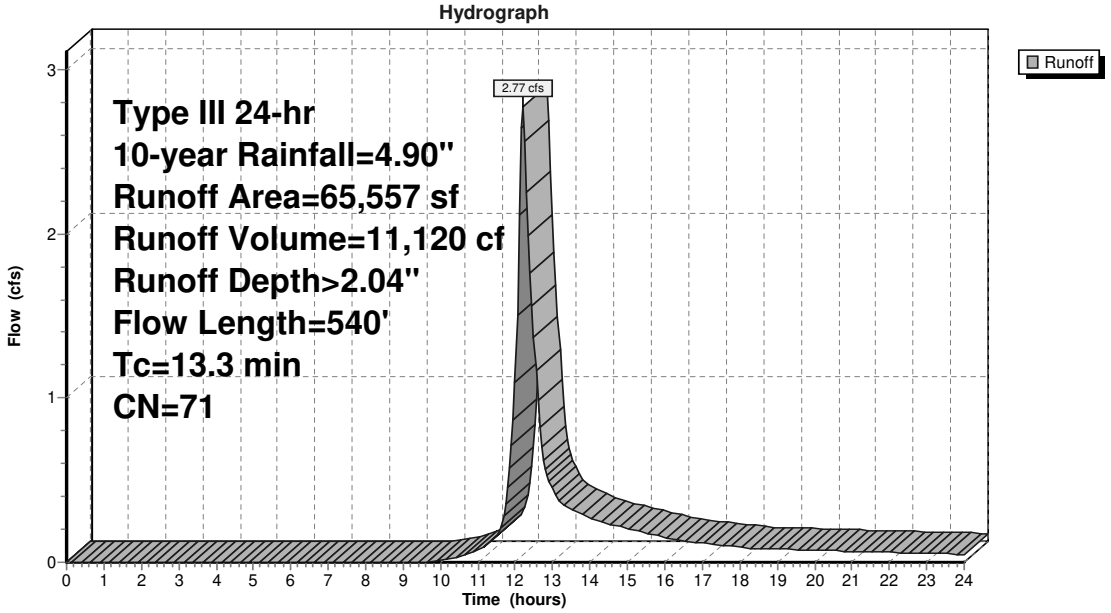
Runoff = 2.77 cfs @ 12.19 hrs, Volume= 11,120 cf, Depth> 2.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.90"

Area (sf)	CN	Description
11,685	74	>75% Grass cover, Good, HSG C
52,113	70	Woods, Good, HSG C
1,759	98	Roofs, HSG C
65,557	71	Weighted Average
63,798		97.32% Pervious Area
1,759		2.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.5	70	0.0200	2.28		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
4.1	260	0.0450	1.06		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
0.5	160	0.0170	5.83	34.97	**Channel Flow, D-E** Area= 6.0 sf Perim= 7.0' r= 0.86' n= 0.030
13.3	540	Total			

Subcatchment 3D: Post Dev



Summary for Subcatchment 4D: Post Dev

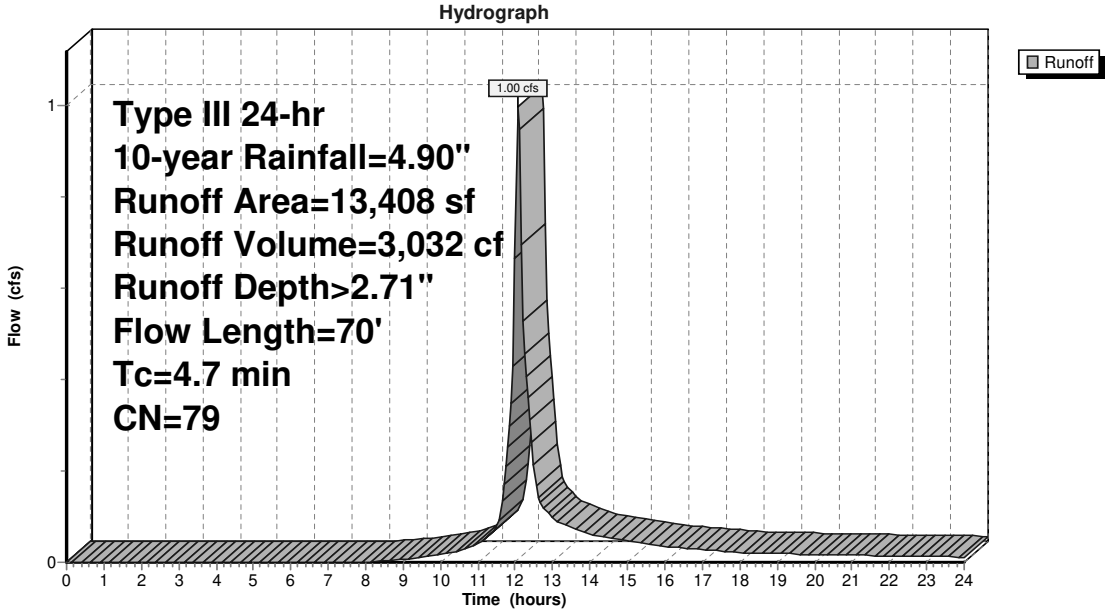
Runoff = 1.00 cfs @ 12.07 hrs, Volume= 3,032 cf, Depth> 2.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.90"

Area (sf)	CN	Description
3,474	98	Roofs, HSG C
4,913	70	Woods, Good, HSG C
5,021	74	>75% Grass cover, Good, HSG C
13,408	79	Weighted Average
9,934		74.09% Pervious Area
3,474		25.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	35	0.0450	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.2	35	0.0400	3.22		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
4.7	70	Total			

Subcatchment 4D: Post Dev



Summary for Subcatchment 5D: Post Dev

Runoff = 1.63 cfs @ 12.09 hrs, Volume= 5,216 cf, Depth> 3.27"

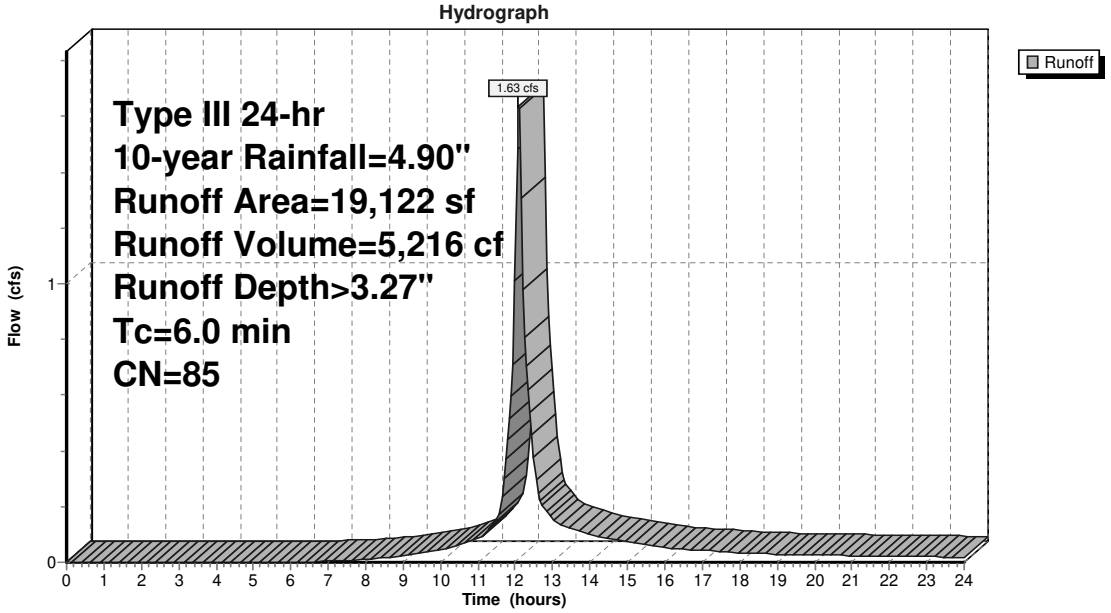
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.90"

Area (sf)	CN	Description
2,340	98	Paved parking, HSG C
4,998	98	Paved roads w/curbs & sewers, HSG C
1,212	98	Roofs, HSG C
10,572	74	>75% Grass cover, Good, HSG C
19,122	85	Weighted Average
10,572		55.29% Pervious Area
8,550		44.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 5D: Post Dev

Hydrograph



Summary for Pond 1P: Det Pond #1

Inflow Area = 76,073 sf, 58.47% Impervious, Inflow Depth > 3.12" for 10-year event
Inflow = 5.32 cfs @ 12.17 hrs, Volume= 19,767 cf
Outflow = 2.53 cfs @ 12.47 hrs, Volume= 14,899 cf, Atten= 52%, Lag= 18.1 min
Primary = 2.53 cfs @ 12.47 hrs, Volume= 14,899 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 110.43' @ 12.47 hrs Surf.Area= 5,716 sf Storage= 8,121 cf

Plug-Flow detention time= 158.8 min calculated for 14,868 cf (75% of inflow)
Center-of-Mass det. time= 84.0 min (899.7 - 815.7)

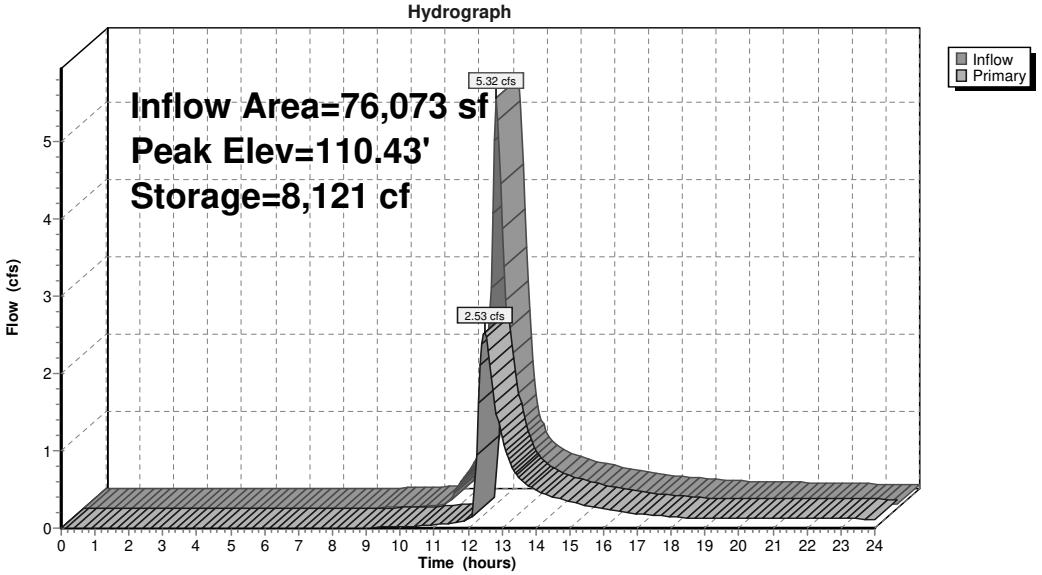
Volume	Invert	Avail.Storage	Storage Description
#1	108.50'	18,291 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
108.50	50	100.0	0	0	50
108.70	1,481	179.0	120	120	1,804
109.00	4,281	337.0	828	948	8,292
110.00	5,295	393.0	4,779	5,727	11,566
111.00	6,286	403.0	5,783	11,511	12,314
112.00	7,287	415.0	6,780	18,291	13,196

Device	Routing	Invert	Outlet Devices
#1	Primary	108.50'	**18.0" Round Culvert** L= 20.0' Ke= 0.500 Inlet / Outlet Invert= 108.50' / 108.00' S= 0.0250 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	108.50'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	111.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	110.00'	**2.5' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.0' Crest Height

Primary OutFlow Max=2.51 cfs @ 12.47 hrs HW=110.43' (Free Discharge)
└**1=Culvert** (Passes 2.51 cfs of 9.26 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.14 cfs @ 6.55 fps)
  ├**3=Orifice/Grate** (Controls 0.00 cfs)
  └**4=Sharp-Crested Rectangular Weir** (Weir Controls 2.37 cfs @ 2.27 fps)

Pond 1P: Det Pond #1



Summary for Pond 1R: Recharge #1R

Inflow Area = 53,833 sf, 73.61% Impervious, Inflow Depth > 3.99" for 10-year event
Inflow = 4.59 cfs @ 12.15 hrs, Volume= 17,879 cf
Outflow = 4.29 cfs @ 12.20 hrs, Volume= 16,179 cf, Atten= 6%, Lag= 2.8 min
Discarded = 0.02 cfs @ 5.75 hrs, Volume= 1,441 cf
Primary = 4.27 cfs @ 12.20 hrs, Volume= 14,738 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 111.97' @ 12.20 hrs Surf.Area= 1,731 sf Storage= 2,752 cf

Plug-Flow detention time= 76.4 min calculated for 16,179 cf (90% of inflow)
Center-of-Mass det. time= 29.9 min (817.3 - 787.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	109.50'	1,693 cf	**13.17'W x 131.50'L x 3.54'H Field A** 6,132 cf Overall - 1,900 cf Embedded = 4,232 cf x 40.0% Voids
#2A	110.00'	1,900 cf	**Cultec R-330XLHD** x 36 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 2 rows
		3,593 cf	Total Available Storage

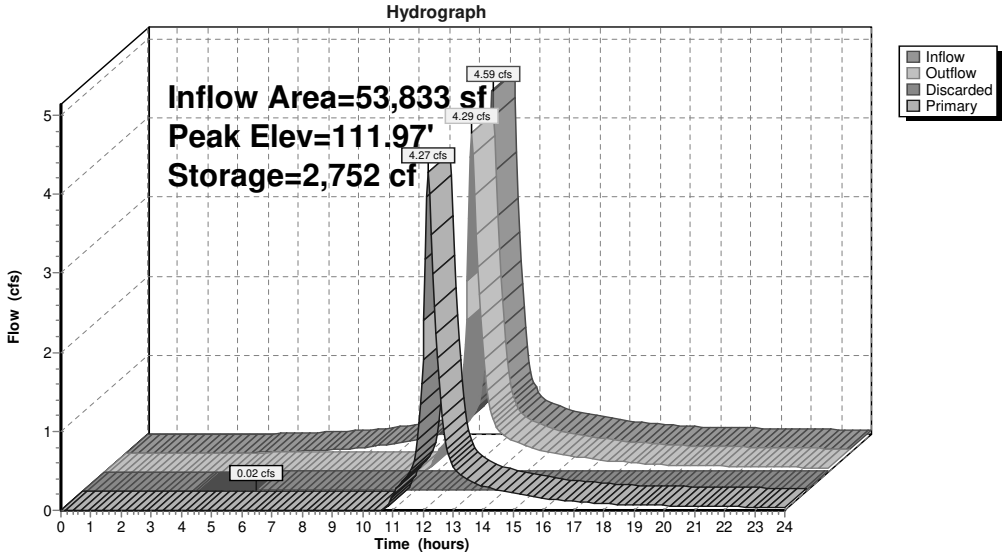
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	109.50'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	111.00'	**12.0" Round Culvert** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 111.00' / 110.90' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#3	Primary	111.00'	**12.0" Round Culvert** L= 10.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 111.00' / 110.90' S= 0.0100 '/' Cc= 0.900 n= 0.010, Flow Area= 0.79 sf

Discarded OutFlow Max=0.02 cfs @ 5.75 hrs HW=109.54' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=4.26 cfs @ 12.20 hrs HW=111.97' (Free Discharge)
├**2=Culvert** (Barrel Controls 2.01 cfs @ 3.29 fps)
└**3=Culvert** (Barrel Controls 2.25 cfs @ 3.66 fps)

Pond 1R: Recharge #1R

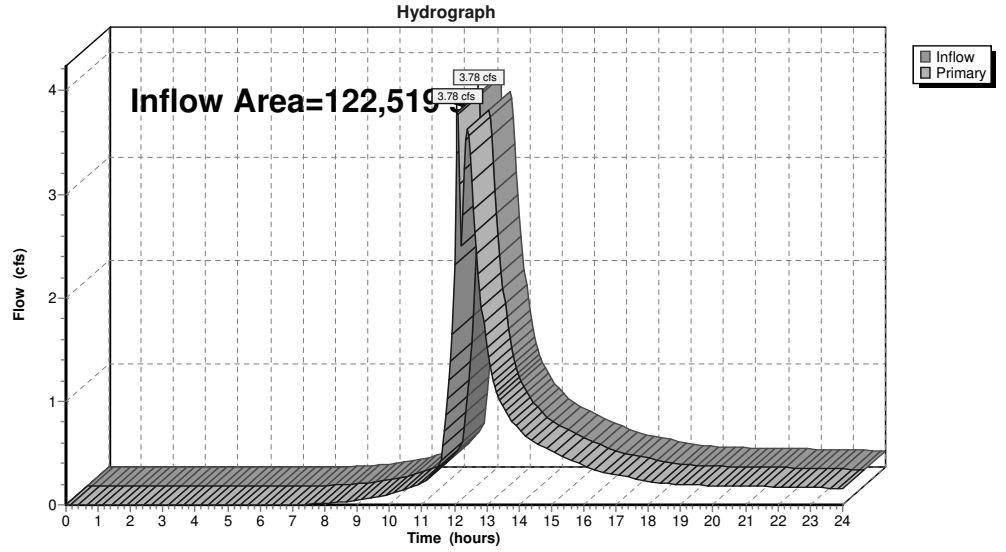


Summary for Link 2L: Post Dev

Inflow Area = 122,519 sf, 48.84% Impervious, Inflow Depth > 2.60" for 10-year event
Inflow = 3.78 cfs @ 12.09 hrs, Volume= 26,557 cf
Primary = 3.78 cfs @ 12.09 hrs, Volume= 26,557 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 2L: Post Dev

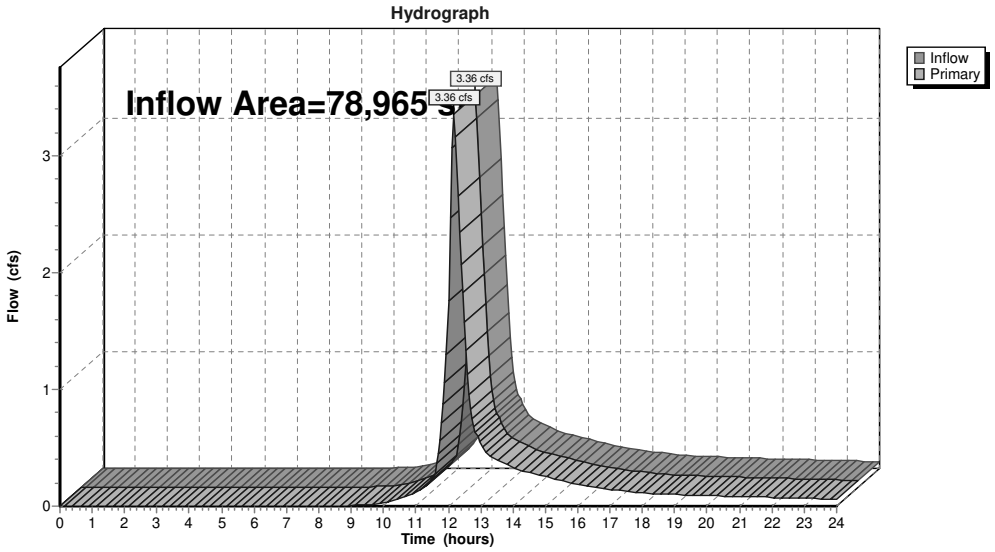


Summary for Link 3L: Post Dev

Inflow Area = 78,965 sf, 6.63% Impervious, Inflow Depth > 2.15" for 10-year event
Inflow = 3.36 cfs @ 12.17 hrs, Volume= 14,152 cf
Primary = 3.36 cfs @ 12.17 hrs, Volume= 14,152 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 3L: Post Dev



Summary for Subcatchment 1D-1: Post Dev

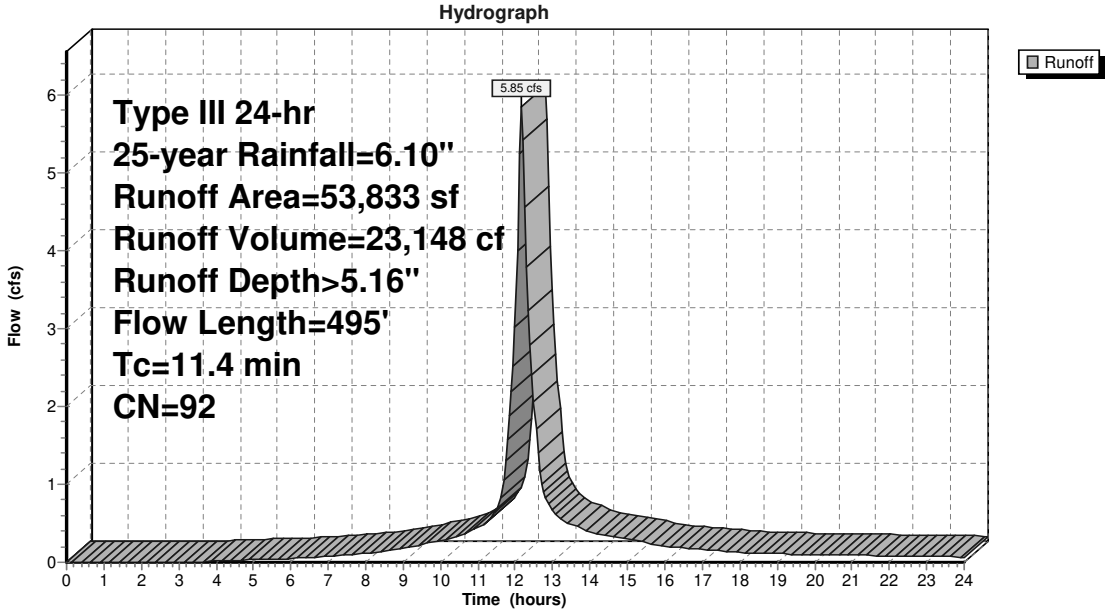
Runoff = 5.85 cfs @ 12.15 hrs, Volume= 23,148 cf, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.10"

	Area (sf)	CN	Description
	18,252	98	Roofs, HSG C
*	6,650	98	Paved Drives, HSG C
*	14,724	98	Paved roads, HSG C
	14,207	74	>75% Grass cover, Good, HSG C
	53,833	92	Weighted Average
	14,207		26.39% Pervious Area
	39,626		73.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.3	40	0.0100	2.03		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
1.5	115	0.0060	1.25		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
0.5	65	0.0100	2.03		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
0.9	225	0.0090	4.30	3.38	**Pipe Channel, E-F** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
11.4	495	Total			

Subcatchment 1D-1: Post Dev



Summary for Subcatchment 1D-2: Post Dev

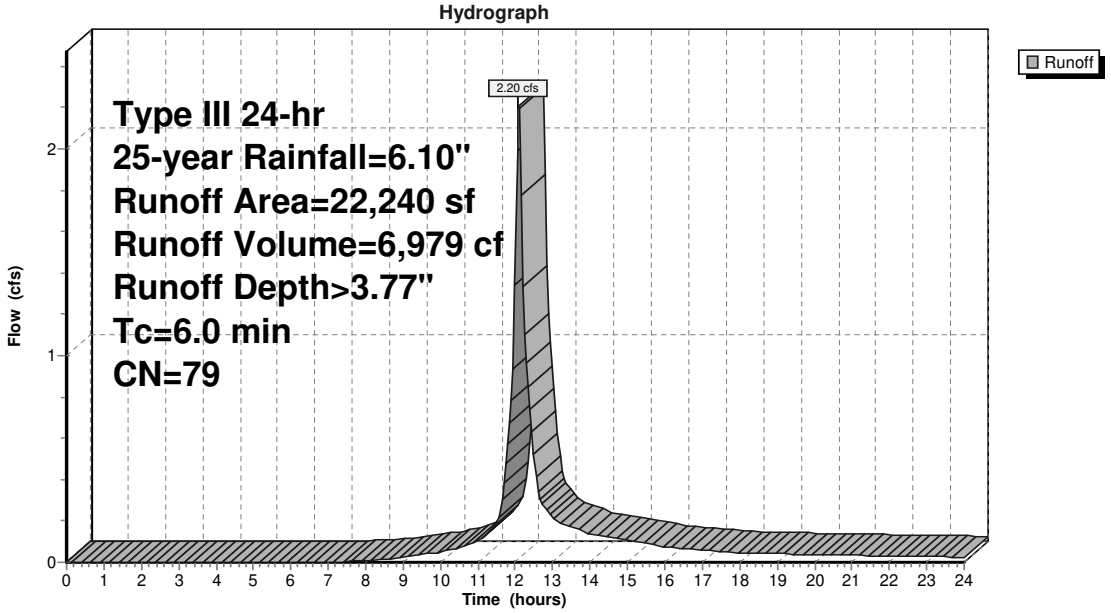
Runoff = 2.20 cfs @ 12.09 hrs, Volume= 6,979 cf, Depth> 3.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.10"

	Area (sf)	CN	Description
	17,385	74	>75% Grass cover, Good, HSG C
*	4,855	98	Drain Basin
	22,240	79	Weighted Average
	17,385		78.17% Pervious Area
	4,855		21.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 1D-2: Post Dev



Summary for Subcatchment 2D1: Post Dev

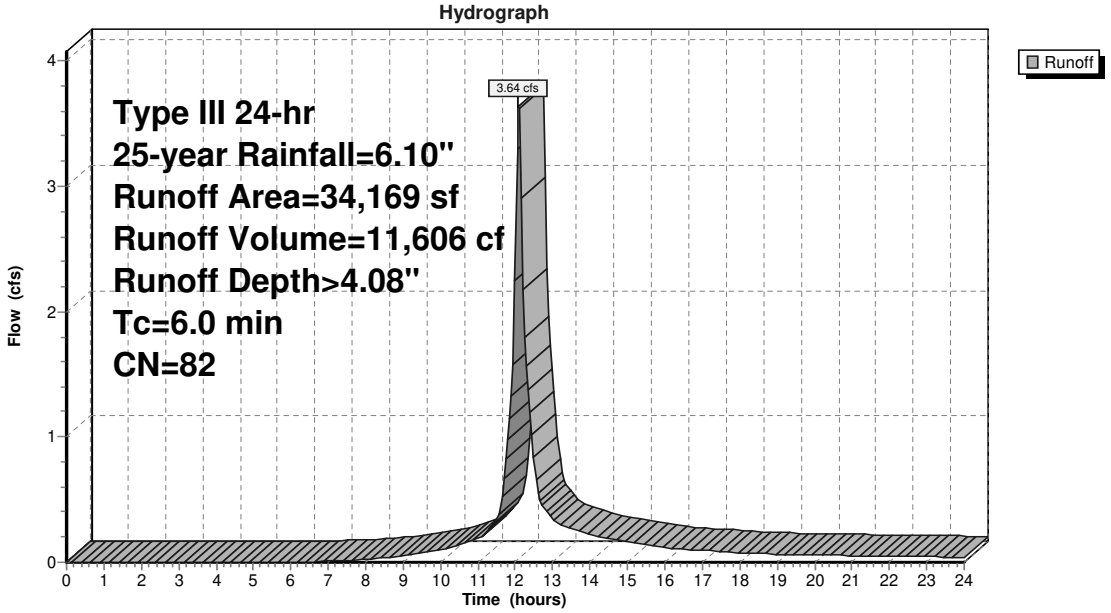
Runoff = 3.64 cfs @ 12.09 hrs, Volume= 11,606 cf, Depth> 4.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.10"

	Area (sf)	CN	Description
*	9,511	98	Paved, HSG C
*	1,265	98	Roof, HSG C
	21,464	74	>75% Grass cover, Good, HSG C
*	1,929	77	Wetlands, Woods, Good, HSG D
	34,169	82	Weighted Average
	23,393		68.46% Pervious Area
	10,776		31.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 2D1: Post Dev



Summary for Subcatchment 2D2: Post Dev

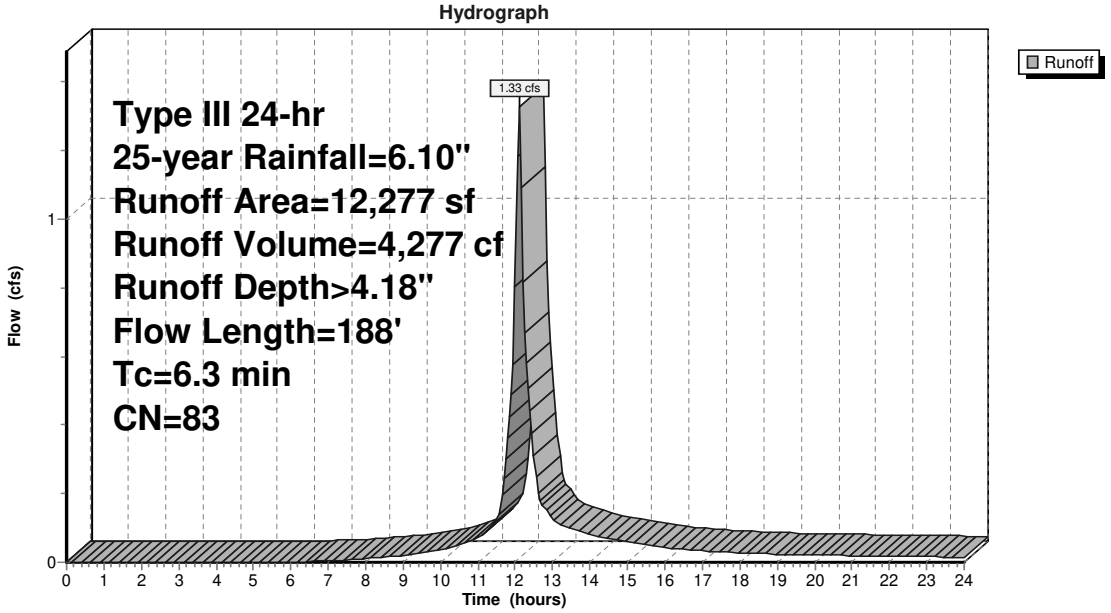
Runoff = 1.33 cfs @ 12.09 hrs, Volume= 4,277 cf, Depth> 4.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.10"

	Area (sf)	CN	Description
*	1,912	98	Paved road, HSG C
*	1,421	98	Drives, HSG C
	1,254	98	Roofs, HSG C
	7,690	74	>75% Grass cover, Good, HSG C
	12,277	83	Weighted Average
	7,690		62.64% Pervious Area
	4,587		37.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	28	0.0600	0.09		**Sheet Flow, A-b** Grass: Bermuda n= 0.410 P2= 3.20"
0.7	85	0.0100	2.03		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
0.5	75	0.0050	2.62	15.69	**Channel Flow, C-D** Area= 6.0 sf Perim= 9.3' r= 0.65' n= 0.030 Earth, grassed & winding
6.3	188	Total			

Subcatchment 2D2: Post Dev



Summary for Subcatchment 3D: Post Dev

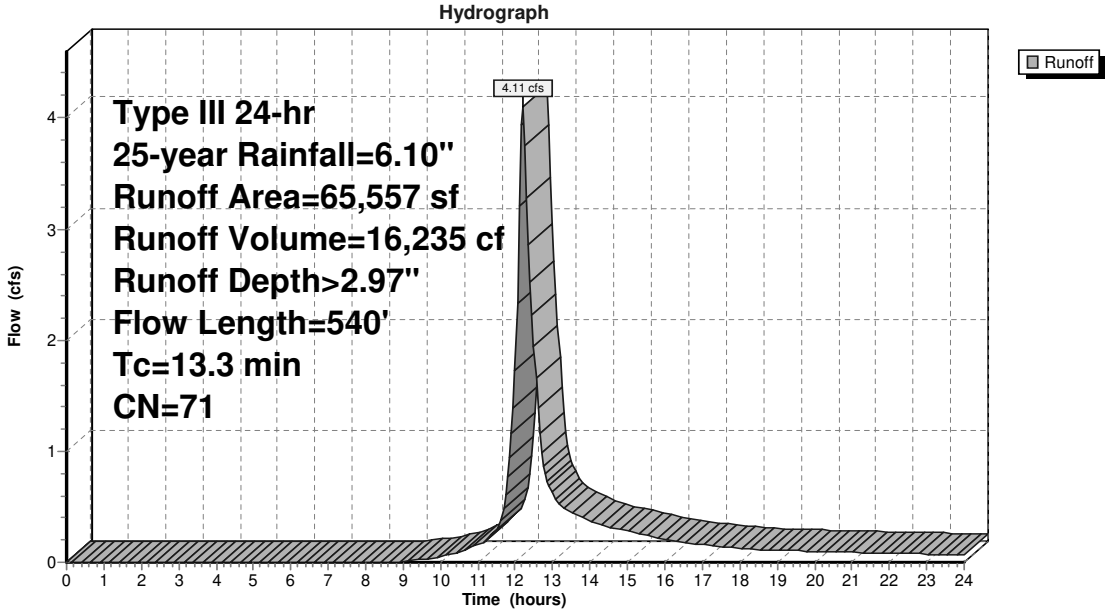
Runoff = 4.11 cfs @ 12.19 hrs, Volume= 16,235 cf, Depth> 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.10"

Area (sf)	CN	Description
11,685	74	>75% Grass cover, Good, HSG C
52,113	70	Woods, Good, HSG C
1,759	98	Roofs, HSG C
65,557	71	Weighted Average
63,798		97.32% Pervious Area
1,759		2.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.5	70	0.0200	2.28		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
4.1	260	0.0450	1.06		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
0.5	160	0.0170	5.83	34.97	**Channel Flow, D-E** Area= 6.0 sf Perim= 7.0' r= 0.86' n= 0.030
13.3	540	Total			

Subcatchment 3D: Post Dev



Summary for Subcatchment 4D: Post Dev

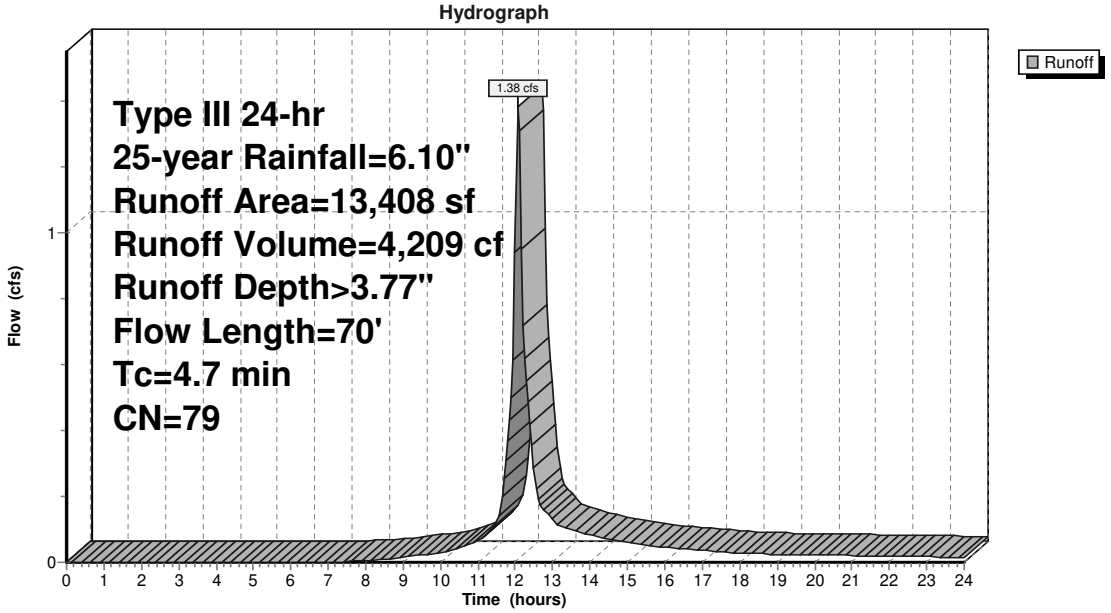
Runoff = 1.38 cfs @ 12.07 hrs, Volume= 4,209 cf, Depth> 3.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.10"

Area (sf)	CN	Description
3,474	98	Roofs, HSG C
4,913	70	Woods, Good, HSG C
5,021	74	>75% Grass cover, Good, HSG C
13,408	79	Weighted Average
9,934		74.09% Pervious Area
3,474		25.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	35	0.0450	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.2	35	0.0400	3.22		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
4.7	70	Total			

Subcatchment 4D: Post Dev



Summary for Subcatchment 5D: Post Dev

Runoff = 2.17 cfs @ 12.09 hrs, Volume= 7,001 cf, Depth> 4.39"

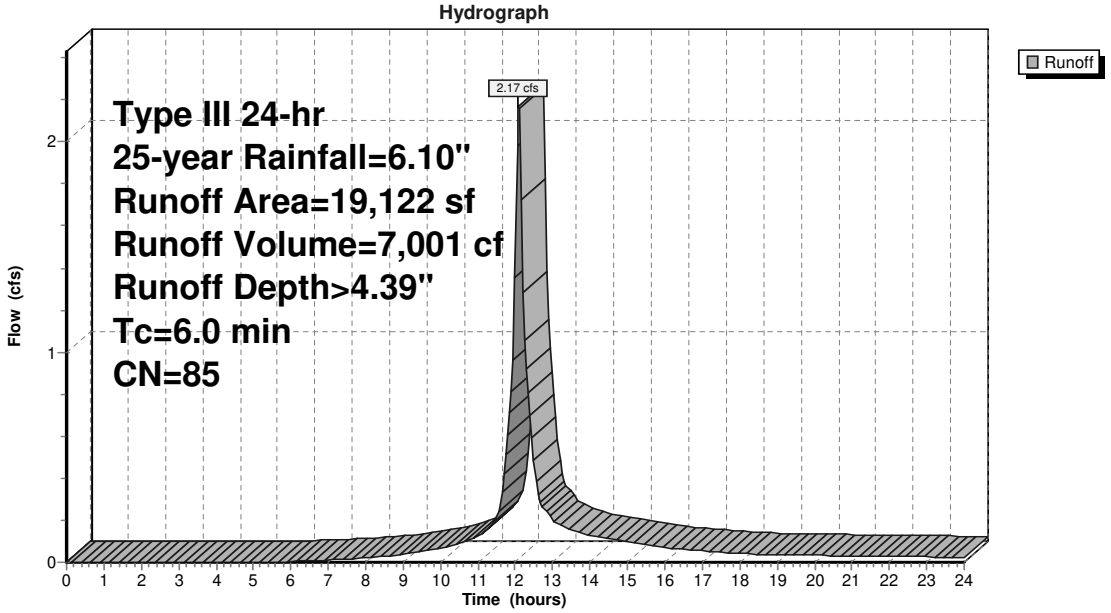
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.10"

Area (sf)	CN	Description
2,340	98	Paved parking, HSG C
4,998	98	Paved roads w/curbs & sewers, HSG C
1,212	98	Roofs, HSG C
10,572	74	>75% Grass cover, Good, HSG C
19,122	85	Weighted Average
10,572		55.29% Pervious Area
8,550		44.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 5D: Post Dev

Hydrograph



Summary for Pond 1P: Det Pond #1

Inflow Area = 76,073 sf, 58.47% Impervious, Inflow Depth > 4.24" for 25-year event
Inflow = 6.87 cfs @ 12.17 hrs, Volume= 26,909 cf
Outflow = 4.60 cfs @ 12.36 hrs, Volume= 21,593 cf, Atten= 33%, Lag= 11.6 min
Primary = 4.60 cfs @ 12.36 hrs, Volume= 21,593 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 110.66' @ 12.36 hrs Surf.Area= 5,936 sf Storage= 9,409 cf

Plug-Flow detention time= 125.7 min calculated for 21,593 cf (80% of inflow)
Center-of-Mass det. time= 57.3 min (865.5 - 808.2)

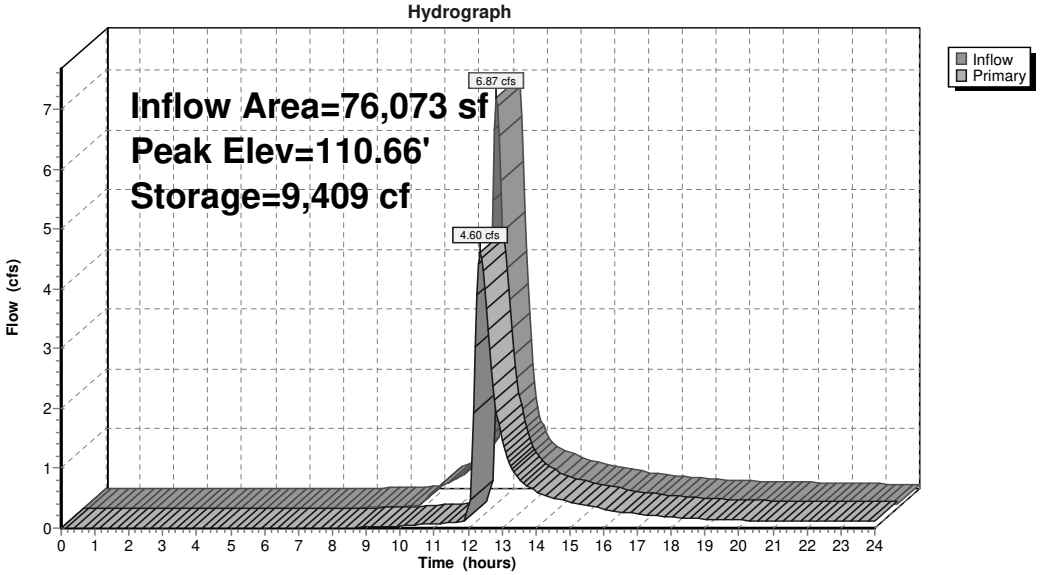
Volume	Invert	Avail.Storage	Storage Description
#1	108.50'	18,291 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
108.50	50	100.0	0	0	50
108.70	1,481	179.0	120	120	1,804
109.00	4,281	337.0	828	948	8,292
110.00	5,295	393.0	4,779	5,727	11,566
111.00	6,286	403.0	5,783	11,511	12,314
112.00	7,287	415.0	6,780	18,291	13,196

Device	Routing	Invert	Outlet Devices
#1	Primary	108.50'	**18.0" Round Culvert** L= 20.0' Ke= 0.500 Inlet / Outlet Invert= 108.50' / 108.00' S= 0.0250 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	108.50'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	111.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	110.00'	**2.5' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.0' Crest Height

Primary OutFlow Max=4.58 cfs @ 12.36 hrs HW=110.65' (Free Discharge)
└**1=Culvert** (Passes 4.58 cfs of 10.08 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.15 cfs @ 6.93 fps)
  ├**3=Orifice/Grate** (Controls 0.00 cfs)
  └**4=Sharp-Crested Rectangular Weir** (Weir Controls 4.43 cfs @ 2.86 fps)

Pond 1P: Det Pond #1



Summary for Pond 1R: Recharge #1R

Inflow Area = 53,833 sf, 73.61% Impervious, Inflow Depth > 5.16" for 25-year event
Inflow = 5.85 cfs @ 12.15 hrs, Volume= 23,148 cf
Outflow = 5.43 cfs @ 12.20 hrs, Volume= 21,433 cf, Atten= 7%, Lag= 2.9 min
Discarded = 0.02 cfs @ 4.75 hrs, Volume= 1,503 cf
Primary = 5.40 cfs @ 12.20 hrs, Volume= 19,930 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 112.19' @ 12.20 hrs Surf.Area= 1,731 sf Storage= 2,968 cf

Plug-Flow detention time= 66.1 min calculated for 21,433 cf (93% of inflow)
Center-of-Mass det. time= 27.4 min (808.1 - 780.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	109.50'	1,693 cf	**13.17'W x 131.50'L x 3.54'H Field A** 6,132 cf Overall - 1,900 cf Embedded = 4,232 cf x 40.0% Voids
#2A	110.00'	1,900 cf	**Cultec R-330XLHD** x 36 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 2 rows
		3,593 cf	Total Available Storage

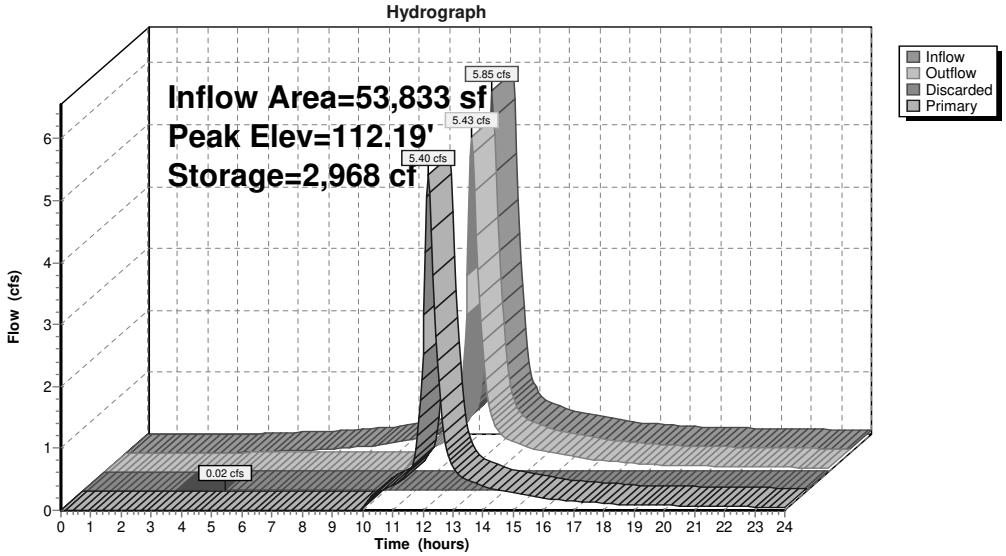
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	109.50'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	111.00'	**12.0" Round Culvert** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 111.00' / 110.90' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#3	Primary	111.00'	**12.0" Round Culvert** L= 10.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 111.00' / 110.90' S= 0.0100 '/' Cc= 0.900 n= 0.010, Flow Area= 0.79 sf

Discarded OutFlow Max=0.02 cfs @ 4.75 hrs HW=109.54' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=5.39 cfs @ 12.20 hrs HW=112.19' (Free Discharge)
├**2=Culvert** (Inlet Controls 2.48 cfs @ 3.15 fps)
└**3=Culvert** (Barrel Controls 2.91 cfs @ 3.94 fps)

Pond 1R: Recharge #1R

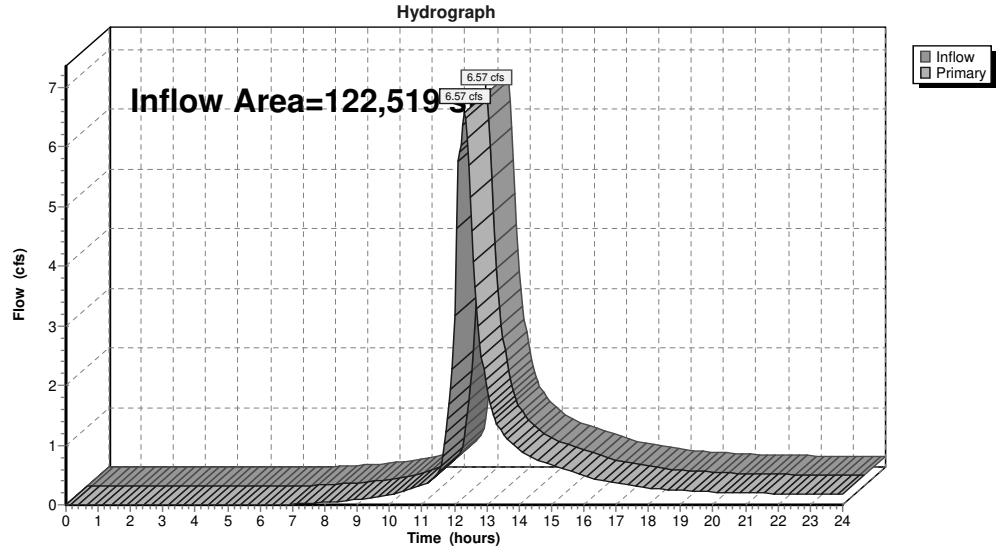


Summary for Link 2L: Post Dev

Inflow Area = 122,519 sf, 48.84% Impervious, Inflow Depth > 3.67" for 25-year event
Inflow = 6.57 cfs @ 12.31 hrs, Volume= 37,476 cf
Primary = 6.57 cfs @ 12.31 hrs, Volume= 37,476 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 2L: Post Dev

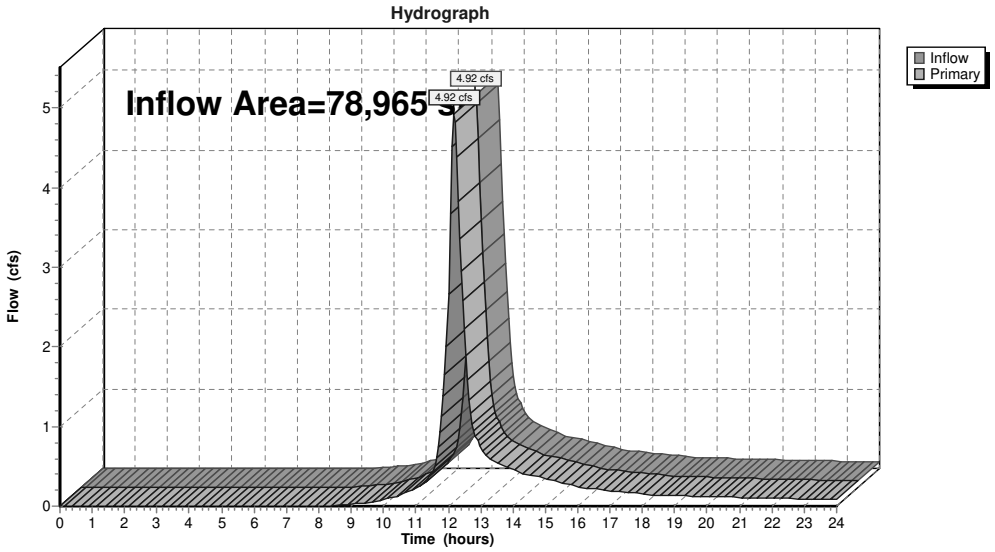


Summary for Link 3L: Post Dev

Inflow Area = 78,965 sf, 6.63% Impervious, Inflow Depth > 3.11" for 25-year event
Inflow = 4.92 cfs @ 12.17 hrs, Volume= 20,444 cf
Primary = 4.92 cfs @ 12.17 hrs, Volume= 20,444 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 3L: Post Dev



Summary for Subcatchment 1D-1: Post Dev

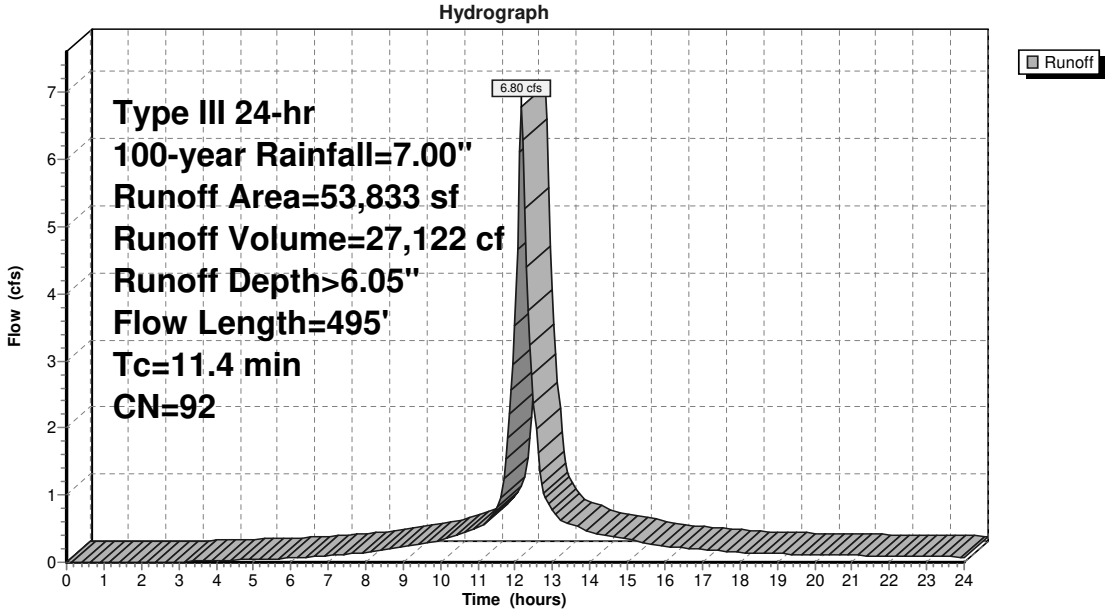
Runoff = 6.80 cfs @ 12.15 hrs, Volume= 27,122 cf, Depth> 6.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.00"

	Area (sf)	CN	Description
	18,252	98	Roofs, HSG C
*	6,650	98	Paved Drives, HSG C
*	14,724	98	Paved roads, HSG C
	14,207	74	>75% Grass cover, Good, HSG C
	53,833	92	Weighted Average
	14,207		26.39% Pervious Area
	39,626		73.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.3	40	0.0100	2.03		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
1.5	115	0.0060	1.25		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
0.5	65	0.0100	2.03		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
0.9	225	0.0090	4.30	3.38	**Pipe Channel, E-F** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
11.4	495	Total			

Subcatchment 1D-1: Post Dev



Summary for Subcatchment 1D-2: Post Dev

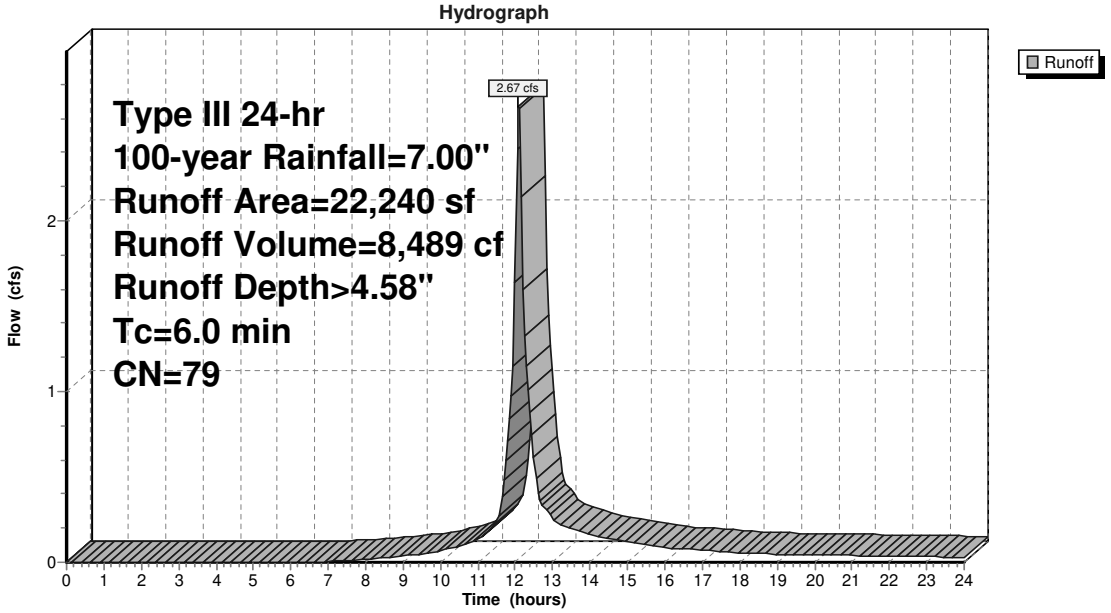
Runoff = 2.67 cfs @ 12.09 hrs, Volume= 8,489 cf, Depth> 4.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.00"

	Area (sf)	CN	Description
	17,385	74	>75% Grass cover, Good, HSG C
*	4,855	98	Drain Basin
	22,240	79	Weighted Average
	17,385		78.17% Pervious Area
	4,855		21.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 1D-2: Post Dev



Summary for Subcatchment 2D1: Post Dev

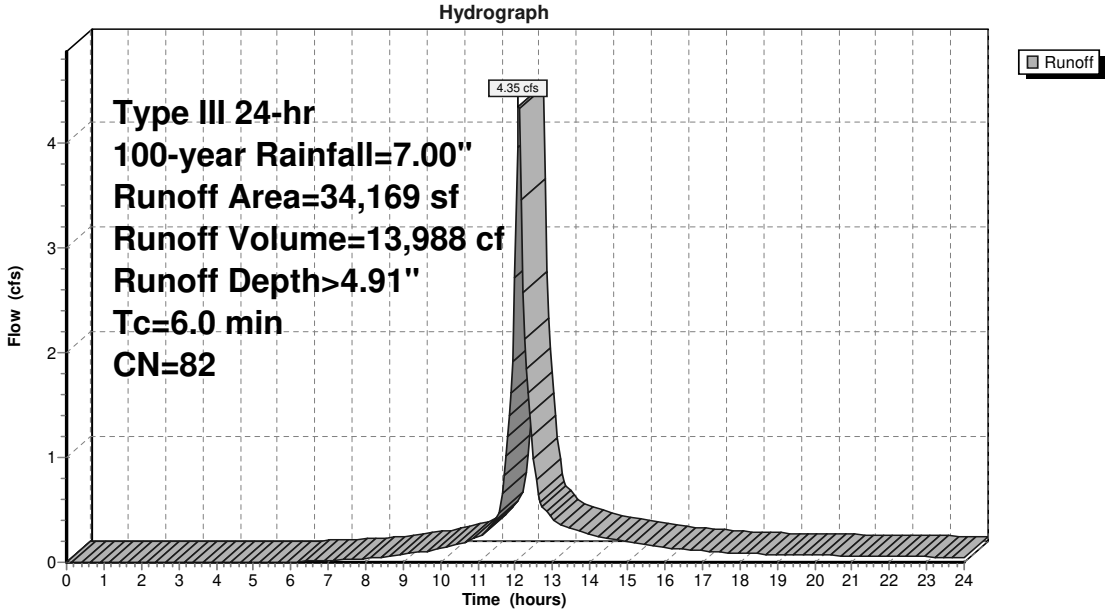
Runoff = 4.35 cfs @ 12.09 hrs, Volume= 13,988 cf, Depth> 4.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.00"

	Area (sf)	CN	Description
*	9,511	98	Paved, HSG C
*	1,265	98	Roof, HSG C
	21,464	74	>75% Grass cover, Good, HSG C
*	1,929	77	Wetlands, Woods, Good, HSG D
	34,169	82	Weighted Average
	23,393		68.46% Pervious Area
	10,776		31.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 2D1: Post Dev



Summary for Subcatchment 2D2: Post Dev

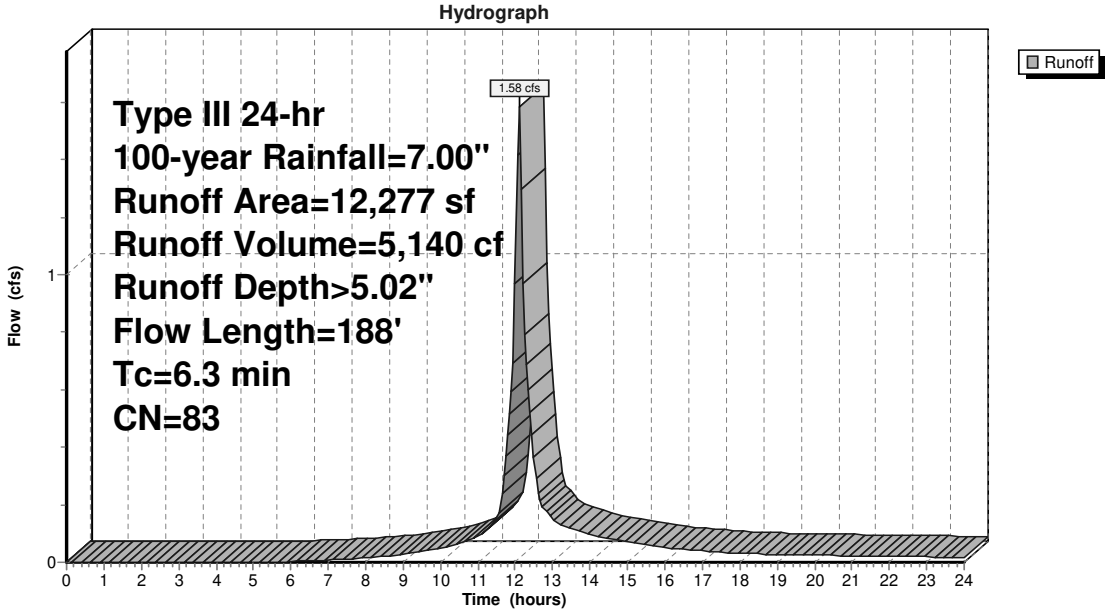
Runoff = 1.58 cfs @ 12.09 hrs, Volume= 5,140 cf, Depth> 5.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.00"

	Area (sf)	CN	Description
*	1,912	98	Paved road, HSG C
*	1,421	98	Drives, HSG C
	1,254	98	Roofs, HSG C
	7,690	74	>75% Grass cover, Good, HSG C
	12,277	83	Weighted Average
	7,690		62.64% Pervious Area
	4,587		37.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	28	0.0600	0.09		**Sheet Flow, A-b** Grass: Bermuda n= 0.410 P2= 3.20"
0.7	85	0.0100	2.03		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
0.5	75	0.0050	2.62	15.69	**Channel Flow, C-D** Area= 6.0 sf Perim= 9.3' r= 0.65' n= 0.030 Earth, grassed & winding
6.3	188	Total			

Subcatchment 2D2: Post Dev



Summary for Subcatchment 3D: Post Dev

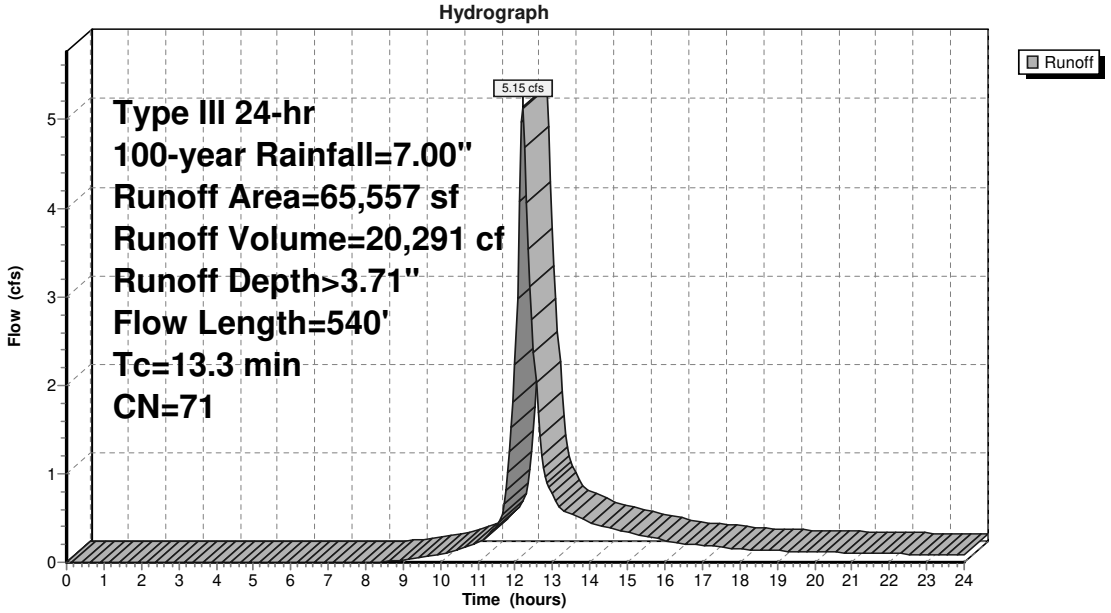
Runoff = 5.15 cfs @ 12.19 hrs, Volume= 20,291 cf, Depth> 3.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.00"

Area (sf)	CN	Description
11,685	74	>75% Grass cover, Good, HSG C
52,113	70	Woods, Good, HSG C
1,759	98	Roofs, HSG C
65,557	71	Weighted Average
63,798		97.32% Pervious Area
1,759		2.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0200	0.10		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.5	70	0.0200	2.28		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
4.1	260	0.0450	1.06		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
0.5	160	0.0170	5.83	34.97	**Channel Flow, D-E** Area= 6.0 sf Perim= 7.0' r= 0.86' n= 0.030
13.3	540	Total			

Subcatchment 3D: Post Dev



Summary for Subcatchment 4D: Post Dev

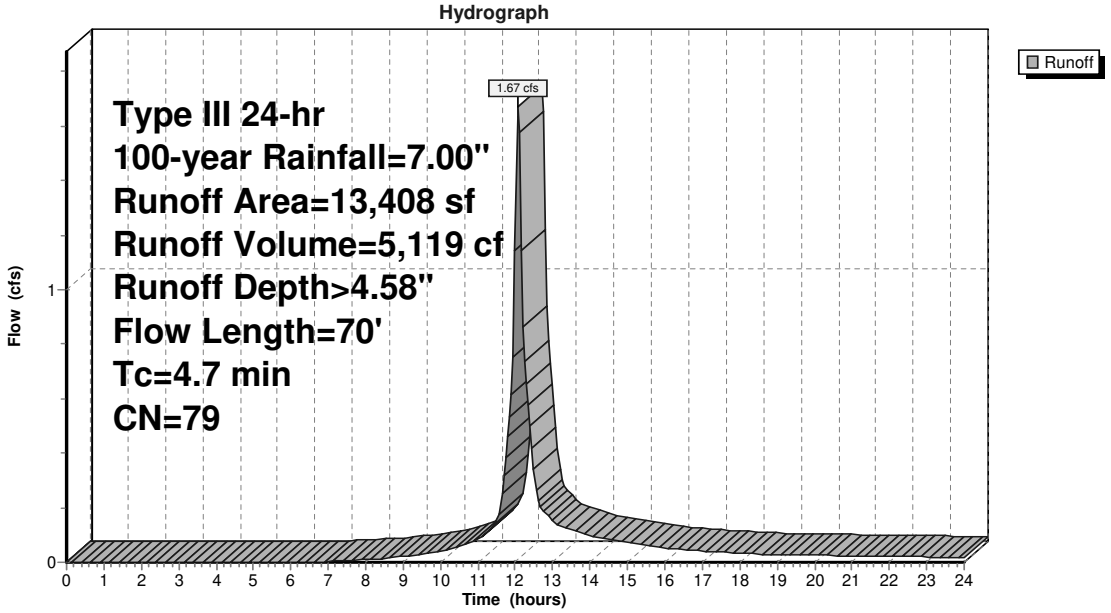
Runoff = 1.67 cfs @ 12.07 hrs, Volume= 5,119 cf, Depth> 4.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.00"

Area (sf)	CN	Description
3,474	98	Roofs, HSG C
4,913	70	Woods, Good, HSG C
5,021	74	>75% Grass cover, Good, HSG C
13,408	79	Weighted Average
9,934		74.09% Pervious Area
3,474		25.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	35	0.0450	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.20"
0.2	35	0.0400	3.22		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
4.7	70	Total			

Subcatchment 4D: Post Dev



Summary for Subcatchment 5D: Post Dev

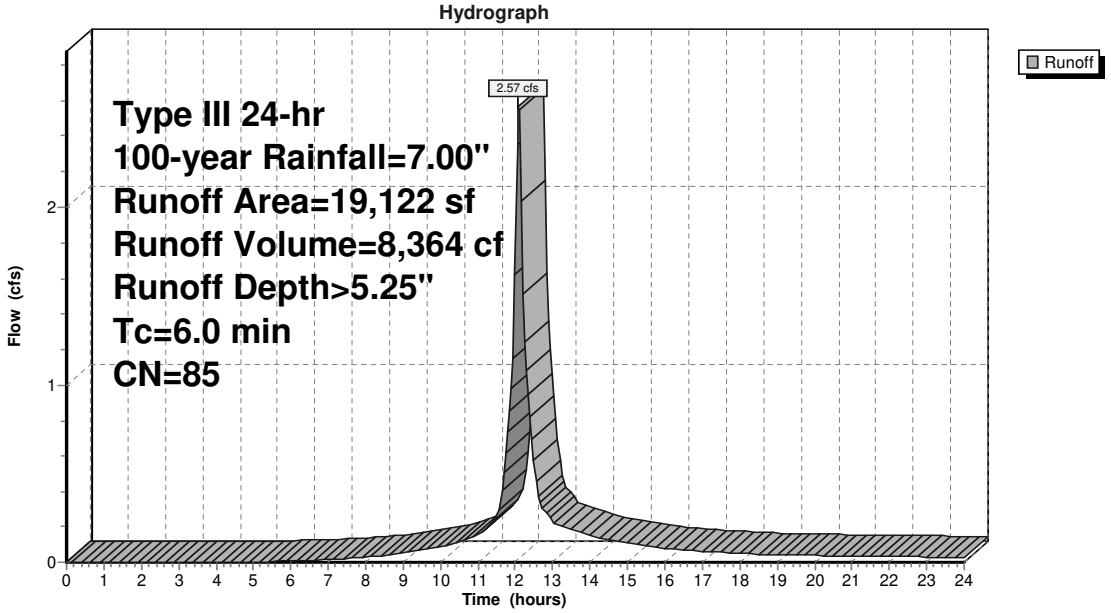
Runoff = 2.57 cfs @ 12.09 hrs, Volume= 8,364 cf, Depth> 5.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.00"

Area (sf)	CN	Description
2,340	98	Paved parking, HSG C
4,998	98	Paved roads w/curbs & sewers, HSG C
1,212	98	Roofs, HSG C
10,572	74	>75% Grass cover, Good, HSG C
19,122	85	Weighted Average
10,572		55.29% Pervious Area
8,550		44.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 5D: Post Dev



Summary for Pond 1P: Det Pond #1

Inflow Area = 76,073 sf, 58.47% Impervious, Inflow Depth > 5.10" for 100-year event
Inflow = 7.96 cfs @ 12.17 hrs, Volume= 32,348 cf
Outflow = 6.06 cfs @ 12.32 hrs, Volume= 26,808 cf, Atten= 24%, Lag= 9.3 min
Primary = 6.06 cfs @ 12.32 hrs, Volume= 26,808 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 110.79' @ 12.32 hrs Surf.Area= 6,072 sf Storage= 10,218 cf

Plug-Flow detention time= 110.6 min calculated for 26,752 cf (83% of inflow)
Center-of-Mass det. time= 47.8 min (851.3 - 803.4)

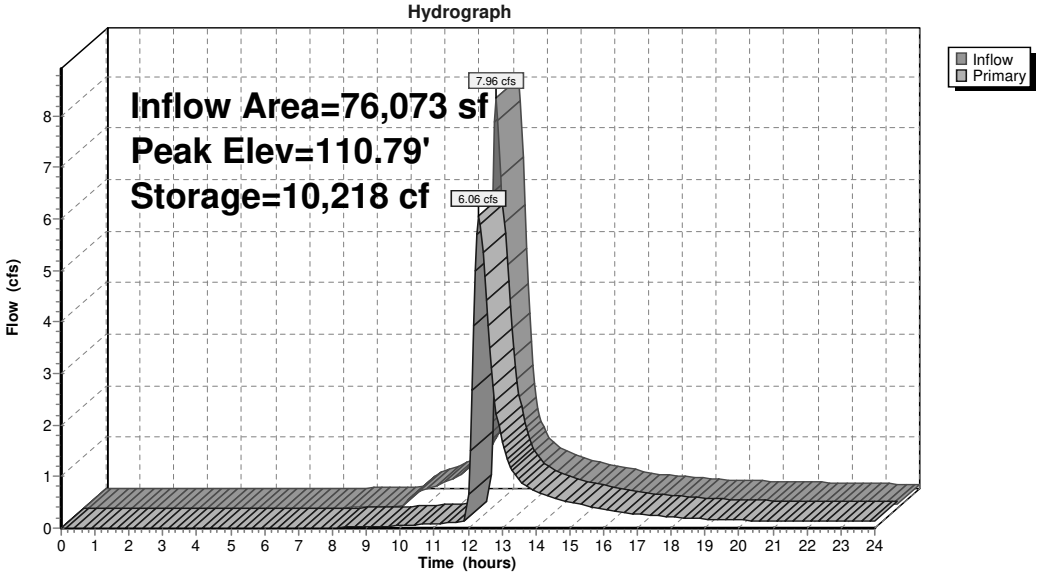
Volume	Invert	Avail.Storage	Storage Description
#1	108.50'	18,291 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
108.50	50	100.0	0	0	50
108.70	1,481	179.0	120	120	1,804
109.00	4,281	337.0	828	948	8,292
110.00	5,295	393.0	4,779	5,727	11,566
111.00	6,286	403.0	5,783	11,511	12,314
112.00	7,287	415.0	6,780	18,291	13,196

Device	Routing	Invert	Outlet Devices
#1	Primary	108.50'	**18.0" Round Culvert** L= 20.0' Ke= 0.500 Inlet / Outlet Invert= 108.50' / 108.00' S= 0.0250 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	108.50'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	111.00'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	110.00'	**2.5' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) 1.0' Crest Height

Primary OutFlow Max=6.02 cfs @ 12.32 hrs HW=110.79' (Free Discharge)
└**1=Culvert** (Passes 6.02 cfs of 10.55 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.16 cfs @ 7.15 fps)
  ├**3=Orifice/Grate** (Controls 0.00 cfs)
  └**4=Sharp-Crested Rectangular Weir** (Weir Controls 5.86 cfs @ 3.18 fps)

Pond 1P: Det Pond #1



Summary for Pond 1R: Recharge #1R

Inflow Area = 53,833 sf, 73.61% Impervious, Inflow Depth > 6.05" for 100-year event
Inflow = 6.80 cfs @ 12.15 hrs, Volume= 27,122 cf
Outflow = 6.28 cfs @ 12.20 hrs, Volume= 25,396 cf, Atten= 8%, Lag= 3.0 min
Discarded = 0.02 cfs @ 4.20 hrs, Volume= 1,537 cf
Primary = 6.26 cfs @ 12.20 hrs, Volume= 23,859 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 112.40' @ 12.21 hrs Surf.Area= 1,731 sf Storage= 3,144 cf

Plug-Flow detention time= 60.3 min calculated for 25,396 cf (94% of inflow)
Center-of-Mass det. time= 25.9 min (802.7 - 776.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	109.50'	1,693 cf	**13.17'W x 131.50'L x 3.54'H Field A** 6,132 cf Overall - 1,900 cf Embedded = 4,232 cf x 40.0% Voids
#2A	110.00'	1,900 cf	**Cultec R-330XLHD** x 36 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 2 rows
		3,593 cf	Total Available Storage

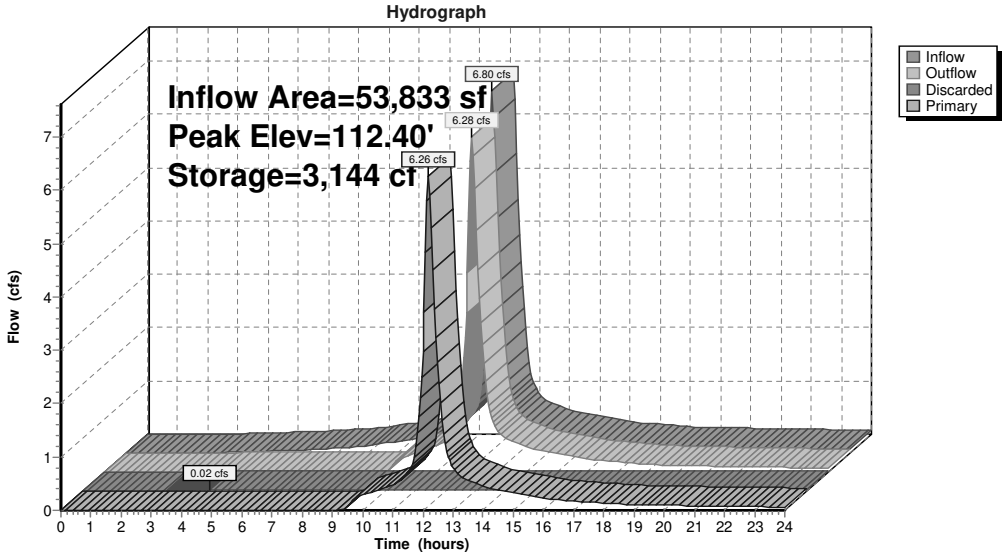
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	109.50'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	111.00'	**12.0" Round Culvert** L= 10.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 111.00' / 110.90' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#3	Primary	111.00'	**12.0" Round Culvert** L= 10.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 111.00' / 110.90' S= 0.0100 '/' Cc= 0.900 n= 0.010, Flow Area= 0.79 sf

Discarded OutFlow Max=0.02 cfs @ 4.20 hrs HW=109.54' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=6.24 cfs @ 12.20 hrs HW=112.39' (Free Discharge)
├**2=Culvert** (Inlet Controls 2.82 cfs @ 3.60 fps)
└**3=Culvert** (Barrel Controls 3.41 cfs @ 4.35 fps)

Pond 1R: Recharge #1R

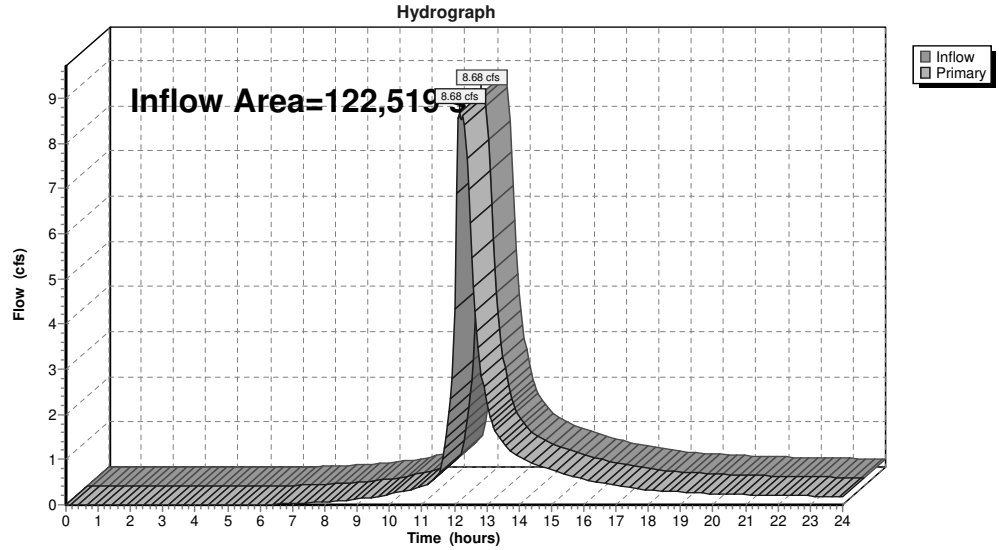


Summary for Link 2L: Post Dev

Inflow Area = 122,519 sf, 48.84% Impervious, Inflow Depth > 4.50" for 100-year event
Inflow = 8.68 cfs @ 12.15 hrs, Volume= 45,935 cf
Primary = 8.68 cfs @ 12.15 hrs, Volume= 45,935 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 2L: Post Dev

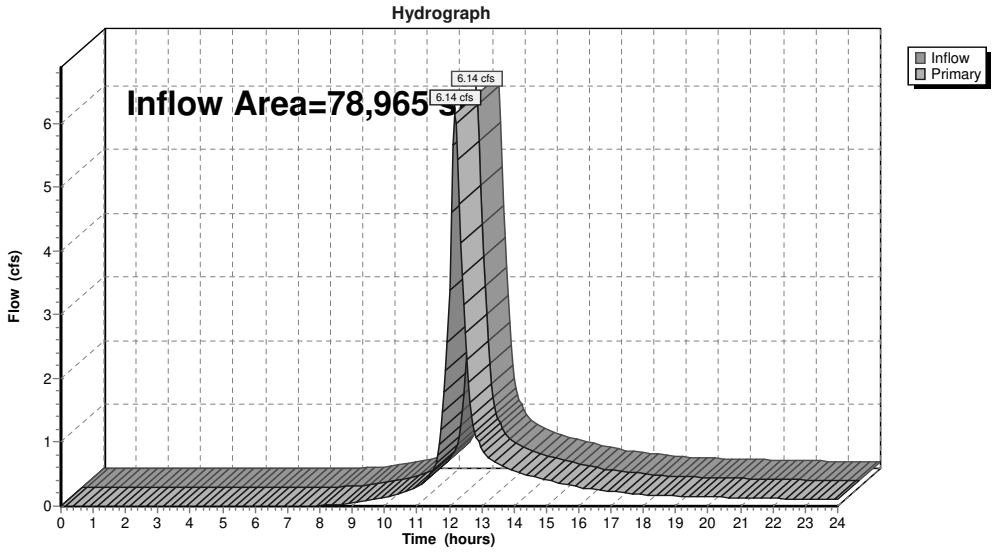


Summary for Link 3L: Post Dev

Inflow Area = 78,965 sf, 6.63% Impervious, Inflow Depth > 3.86" for 100-year event
Inflow = 6.14 cfs @ 12.16 hrs, Volume= 25,411 cf
Primary = 6.14 cfs @ 12.16 hrs, Volume= 25,411 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 3L: Post Dev



APPENDIX – B

Stormwater Recharge Calculations & Water Quality Volumes
Groundwater Mounding Calculations
TSS Removal Calculations
Standards 3 & 4

APPENDIX – B
Stormwater Recharge & Water Quality Volume Calculations
Standard 3:

Project:
The Residences at Burns Avenue
Walpole MA
Revised: Februay 7, 2019; May 29, 2019; July 11, 2019
August 8, 2019; January 20, 2020; May 21, 2020
February 8, 2022; May 5, 2022

WATER QUALITY VOLUME CALCULATIONS
Proprietary BMP is being provided at all three (3) discharge points to treat water quality volume.
Water Quality Volume (WQV): 1-inch

WQV Converted to a flow rate for sizing of Proprietary BMP's
Using DEP Method to convert wqv to a rate:
Q=(qu)(A)(WQV)
Qu=unit peak discharge, in csm/in (Figure 2)
A = impervious area (in square miles)

DMH #4
Paved Imp. Area = 26,465 s.f. = 0.60 ac
Tc = 5 min = 0.083 hrs
Q = (795 csm/in)(0.60 ac)(0.0015625 mi2/ac)(1 in)
Q = 0.8 cfs
Design rate: 1.0 c.f.s.

DMH #10
Paved Imp. Area = 8,938 s.f. = 0.21 ac
Tc = 5 min. = 0.083 hrs
Q = (795 csm/in)(0.21 ac)(0.0015625 mi2/ac)(1 in)
Q = 0.3 cfs
Design rate: 1.0 c.f.s.

DMH #14
Paved Imp. Area = 4,997 s.f. = 0.11 ac
Tc = 5 min. = 0.083 hrs
Q = (795 csm/in)(0.11 ac)(0.0015625 mi2/ac)(1 in)
Q = 0.2 cfs
Design rate: 1.0 c.f.s.

See attached Contech Engineering Solutions
Note: Structure numbers have been modified in the plans.
All units are based on the 1.0 c.f.s. design rate

STORMWATER RECHARGE CALCULATIONS

Impervious Areas*:

Project Site:

Roof:	24,240 sf
Paved:	24,707 sf
Total:	48,947 sf

Impervious Area:	48,947 s.f.
Impervious Area Bypass System:	8,061s.f.
Total Impervious Area to infiltration:	40,886 s.f.

Total Impervious to Recharge System: 48,947 s.f.
Total Impervious Area Uncaptured: 8,061 s.f.
Capture Adjustment:
40,886 s.f. / 48,947 s.f. = 83.5% > 65%
48,947 s.f. / 40,886 s.f. = 1.2 capture adjustment

Rv = F * Impervious Area
Rv = Required Recharge Volume
F = Depth Factor

Hydrologic Soils Group Map indicates that the soils in the recharge areas are Woodbridge fine sandy loam and Montauk fine sandy loam. Witnessed on-site soil testing revealed the substratum soils in the areas of the infiltration facilities consisting of sand, gravel, and loam. The required recharge volume was calculated utilizing Hydrologic Soil Group "C/D".
Soil Type C – Depth Factor = 0.25 inch

Recharge System:

Imp. Area to Recharge: 48,947 s.f.
Recharge Volume required:
Rv = (0.25 inch * 48,947 s.f.)/ 12 = **1020 c.f.** x Capture Adj. (1.2) = **1,223 c.f.**
Infiltration System (Cultec R-330XLHD)
"Static" Storage Volume Provided**:**
Total volume provided below the outlet El=111.00 = **1,620c.f.**
1,620 cf > 1,223 cf ***ok***
Time to drain:
Drawdown time = Volume/(K*Bottom Area)
Volume = 1,223 cf
K = 0.52 in/hr = 0.043 ft/hr
Bottom Area = 1,731 sf
Drawdown time = 1223/(0.043 ft/hr x 1,731 sf)
Drawdown time = 17 hr < 72 hr ***ok***

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: PRETREATMENT OUTLET to RECHARGE WQU #4 & #10

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
DEEP SUMP CB	0.25	1.00	0.25	0.75
PROPRIETARY TREATMENT CDS	0.81	0.75	0.61	0.14

Total TSS Removal = 87 %

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project:

Prepared By:

Date:

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Non-automated: Mar. 4, 2008

Location: DETENTION BASIN OUTLET

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
DEEP SUMP CB	0.25	1.00	0.25	0.75
PROPIETARY TREATMENT CDS	0.81	0.75	0.61	0.14
RECHARGE	0.80	0.14	0.11	0.03

Total TSS Removal = 97%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project:

Prepared By:

Date:

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: HEADWALL #5

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
DEEP SUMP CB	0.25	1.00	0.25	0.75
PROPRIETARY TREATMENT CDS	0.81	0.75	0.61	

Total TSS Removal = 86 %

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project:

Prepared By:

Date:

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD

BURNS AVE
WALPOLE, MA

Area	**0.60 ac**	Unit Site Designation	**WQU #4**
Weighted C	**0.9**	Rainfall Station #	**68**
t_c	**5 min**		
CDS Model	**1515-3**	CDS Treatment Capacity	**1.0 cfs**

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	9.3%	9.3%	0.01	0.01	9.0
0.04	9.5%	18.8%	0.03	0.03	9.0
0.06	8.7%	27.5%	0.04	0.04	8.2
0.08	10.1%	37.6%	0.05	0.05	9.5
0.10	7.2%	44.8%	0.06	0.06	6.7
0.12	6.0%	50.8%	0.08	0.08	5.5
0.14	6.3%	57.1%	0.09	0.09	5.8
0.16	5.6%	62.7%	0.10	0.10	5.1
0.18	4.7%	67.4%	0.11	0.11	4.2
0.20	3.6%	71.0%	0.13	0.13	3.2
0.25	8.2%	79.1%	0.16	0.16	7.1
0.50	14.9%	94.0%	0.32	0.32	11.3
0.75	3.2%	97.3%	0.47	0.47	2.1
1.00	1.2%	98.5%	0.63	0.63	0.7
1.50	0.7%	99.2%	0.95	0.95	0.2
2.00	0.8%	100.0%	1.26	1.00	0.2
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
					87.7
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	93.4%
				Predicted Net Annual Load Removal Efficiency =	**81.2%**

1 - Based on 10 years of rainfall data from NCDC station 736, Blue Hill, Norfolk County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CONTECH ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD

BURNS AVE
WALPOLE, MA

Area	0.21 ac	Unit Site Designation	WQU #10
Weighted C	0.9	Rainfall Station #	68
t_c	5 min		
CDS Model	1515-3	CDS Treatment Capacity	**1.0 cfs**

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	9.3%	9.3%	0.01	0.01	9.0
0.04	9.5%	18.8%	0.03	0.03	9.0
0.06	8.7%	27.5%	0.04	0.04	8.2
0.08	10.1%	37.6%	0.05	0.05	9.5
0.10	7.2%	44.8%	0.06	0.06	6.7
0.12	6.0%	50.8%	0.08	0.08	5.5
0.14	6.3%	57.1%	0.09	0.09	5.8
0.16	5.6%	62.7%	0.10	0.10	5.1
0.18	4.7%	67.4%	0.11	0.11	4.2
0.20	3.6%	71.0%	0.13	0.13	3.2
0.25	8.2%	79.1%	0.16	0.16	7.1
0.50	14.9%	94.0%	0.32	0.32	11.3
0.75	3.2%	97.3%	0.47	0.47	2.1
1.00	1.2%	98.5%	0.63	0.63	0.7
1.50	0.7%	99.2%	0.95	0.95	0.2
2.00	0.8%	100.0%	1.26	1.00	0.2
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
					87.7
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	93.4%
				Predicted Net Annual Load Removal Efficiency =	**81.2%**

1 - Based on 10 years of rainfall data from NCDC station 736, Blue Hill, Norfolk County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CONTECH ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD

BURNS AVE
WALPOLE, MA

Area	0.11 ac	Unit Site Designation	WQU #14
Weighted C	0.9	Rainfall Station #	68
t_c	5 min		
CDS Model	1515-3	CDS Treatment Capacity	**1.0 cfs**

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	9.3%	9.3%	0.01	0.01	9.0
0.04	9.5%	18.8%	0.03	0.03	9.0
0.06	8.7%	27.5%	0.04	0.04	8.2
0.08	10.1%	37.6%	0.05	0.05	9.5
0.10	7.2%	44.8%	0.06	0.06	6.7
0.12	6.0%	50.8%	0.08	0.08	5.5
0.14	6.3%	57.1%	0.09	0.09	5.8
0.16	5.6%	62.7%	0.10	0.10	5.1
0.18	4.7%	67.4%	0.11	0.11	4.2
0.20	3.6%	71.0%	0.13	0.13	3.2
0.25	8.2%	79.1%	0.16	0.16	7.1
0.50	14.9%	94.0%	0.32	0.32	11.3
0.75	3.2%	97.3%	0.47	0.47	2.1
1.00	1.2%	98.5%	0.63	0.63	0.7
1.50	0.7%	99.2%	0.95	0.95	0.2
2.00	0.8%	100.0%	1.26	1.00	0.2
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
					87.7
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	93.4%
				Predicted Net Annual Load Removal Efficiency =	**81.2%**

1 - Based on 10 years of rainfall data from NCDC station 736, Blue Hill, Norfolk County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

The Residences at Burns Avenue
Leaching Trench Mounding Calculation
May 5, 2022

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

hours	days
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

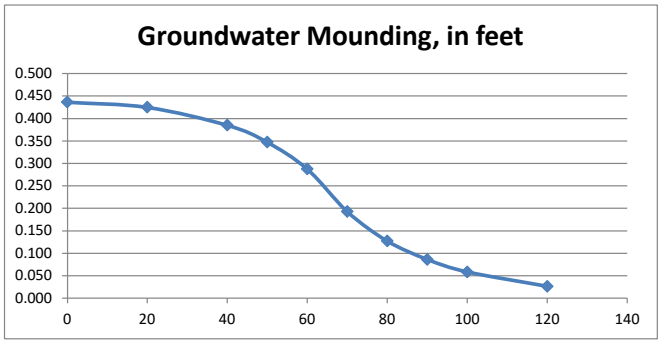
Input Values

0.8900	***R***	**Recharge (infiltration) rate (feet/day)**
0.330	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
10.40	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
65.750	**x**	**1/2 length of basin (x direction, in feet)**
6.580	**y**	**1/2 width of basin (y direction, in feet)**
1.000	**t**	**duration of infiltration period (days)**
50.000	**hi(0)**	**initial thickness of saturated zone (feet)**

50.436	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.436	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
0.436	**0**
0.425	**20**
0.385	**40**
0.347	**50**
0.287	**60**
0.192	**70**
0.127	**80**
0.086	**90**
0.058	**100**
0.026	**120**

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

APPENDIX – C

Hydraulic Analysis & Pipe Sizing

STORM DRAINAGE CALCULATIONS

Pipe Flow Calculations - Manning's Equation

i = Rainfall Intensity at 25 Year Storm

Date: 2/7/19
Revised: 5/5/22
Job No: 15,588
Calc. by: rst

Project: Residences at Burns Ave.
Town: Walpole, MA

Line		Length	Drain Area	Total Area	Runoff	Time of Concentration (min.)			Rainfall i	Required Capacity Q(cfs)		Pipe Diameter	Slope	Design Conditions		Invert Elevation		Rim Elev.	
From	To	(Feet)	(Ac)	(Ac)	"C"	Upper End	In Pipe	Total	(in./hr.)	Inlet	Pipe	(in.)	(ft./ft.)	Depth (in.)	Velocity (f.p.s.)	Upper	Lower	Upper	n
CB 1	DMH 3	30	0.31		0.63	13.81	0.17	13.98	4.61	0.91		12	0.005	5.00	2.90	112.40	112.25	115.40	0.013
CB 2	DMH 3	6	0.30		0.75	11.38	0.02	11.40	4.95	1.10		12	0.025	3.60	5.60	112.40	112.25	115.40	0.013
DMH 3	WQV 4	32		0.61	0.69	13.98	0.12	14.10	4.58		1.92	12	0.009	6.50	4.40	112.15	111.85	115.65	0.013
WQV 4	DMH 5	72		0.61	0.69	14.10	0.27	14.38	4.57		1.91	12	0.009	6.50	4.40	111.65	111.00	116.70	0.013
DMH 5	DMH 5A	27		0.61	0.69	14.38	0.09	14.47	4.53		1.90	12	0.011	6.10	4.80	110.90	110.60	115.00	0.013
DMH 5A	Inlet	16		0.61	0.69	14.38	0.07	14.45	4.53		1.90	12	0.006	7.30	3.80	110.50	110.40	115.00	0.013
CB 7	DMH 9	13	0.10		0.70	10.88	0.08	10.96	5.03	0.37		12	0.008	2.80	2.70	112.20	112.10	115.20	0.013
CB 8	DMH 9	5	0.10		0.70	11.07	0.02	11.09	5.00	0.35		12	0.020	2.10	3.60	112.20	112.10	115.20	0.013
DMH 9	DMH 10	58		0.21	0.70	11.09	0.27	11.36	5.00		0.72	12	0.010	3.70	3.60	112.00	111.40	115.49	0.013
DMH 10	DMH 11	82		0.21	0.70	11.36	0.40	11.76	4.95		0.71	12	0.009	3.70	3.40	111.30	110.60	116.71	0.013
CB 12	DMH 14	13	0.06		0.72	9.82	0.08	9.90	5.21	0.22		12	0.015	1.70	2.80	109.20	109.00	112.38	0.013

OVERLAND FLOW TRAVEL TIME

STORM RUNOFF DATA

Date: **2/7/19**
Revised: **5/5/2022**

Project: **Residences at Burns Ave**
Town: **Walpole, MA**

Job No: **15,588**
Calc. by: **rst**

Structure	Impervious			Lawn			Wooded			Total
	Length (ft)	Slope ('/')	Time (min.)	Length (ft)	Slope ('/')	Time (min.)	Length (ft)	Slope ('/')	Time (min.)	Travel Time (min.)
1	115	0.012	1.65	55	0.020	12.16				13.81
2	185	0.012	2.38	25	0.015	9.00				11.38
7	85	0.020	1.08	30	0.015	9.80				10.88
8	105	0.020	1.27	30	0.015	9.80				11.07
12	60	0.020	0.82	25	0.015	9.00				9.82
13	60	0.020	0.82	25	0.015	9.00				9.82

AVERAGE 'c' VALUE FOR STRUCTURES

STORM RUNOFF DATA

Date: **2/7/19**
Revised: **1/20/2020**
5/5/2022

Project: **Residences at Burns Ave**
Town: **Walpole, MA**

Job No: **15,588**
Calc. by: **RST**

Structure	Total Area (SF)	Ground Cover	Area (SF)	c	Σ(Area*c)	Average c	Total Area (Ac)
CB#1	13,548	imp	6,966	0.95	6,617.70	0.63	0.311
		lawn	6,582	0.30	1,974.60		
		wooded	0	0.20	0.00		
CB#2	12,917	imp	8,886	0.95	8,441.70	0.75	0.297
		lawn	4,031	0.30	1,209.30		
		wooded	0	0.20	0.00		
CB#7	4,532	imp	2,810	0.95	2,669.50	0.70	0.104
		lawn	1,722	0.30	516.60		
		wooded	0	0.20	0.00		
CB#8	4,406	imp	2,714	0.95	2,578.30	0.70	0.101
		lawn	1,692	0.30	507.60		
		wooded	0	0.20	0.00		
CB#12	2,525	imp	1,628	0.95	1,546.60	0.72	0.058
		lawn	897	0.30	269.10		
		wooded	0	0.20	0.00		
CB#13	2,472	imp	1,610	0.95	1,529.50	0.72	0.057

APPENDIX – D

Stormwater Operations & Maintenance Plan

Standard 9

Stormwater Management Operation and Maintenance Plan

Maintenance Agreement
The Residences at Burns Avenue
Off Brool Lane & Burns Ave
Walpole, Massachusetts

May 5, 2022

In accordance with Standard 9 of the Massachusetts Department of Environmental Protection Stormwater Handbook (February 2008), the attached on-site maintenance program for the proposed stormwater management system has been developed to ensure the Best Management Practices (BMP's) in place will remain functioning as designed. The Plan contains both construction period operations and maintenance as well as post construction responsibilities that shall "run" with the property if ownership is transferred.

Land Owner/Operator:

Wall Street Development Corp.
Attn: Lou Petrozzi
P.O. Box 272
Walpole, MA 02090
Phone: 781-326-0306

_____ _____
Date

Construction Period Operation and Maintenance:

- It should be noted that the US EPA mandated NPDES stormwater program requires construction site operators engaged in clearing, grading, and excavating activities that disturb 1 acre or more, including smaller sites in a larger common plan of development or sale, to obtain coverage under an NPDES permit for their stormwater discharges. The Project is subject to this permit and therefore, a Stormwater Pollution Prevention Plan (SWPPP) will be prepared prior to commencement of construction. The SWPPP will contain additional construction period and post construction erosion control requirements.

Erosion Control Barriers:

Compost filter socks shall be installed where indicated on the plans and in other appropriate locations where warranted. These barriers shall be installed prior to the commencement of any work on-site and in accordance with the construction plans. A supply of filter socks and compost filter material shall be kept on-site to replace and/or repair barriers that are damaged or degraded. The barriers shall be observed and maintained on a weekly basis during construction.

Construction Entrances:

The purpose of stabilizing entrances to a construction site is to minimize the amount of sediment leaving the area as mud and sediment attached to vehicles. The entrances shall be sized according to the Massachusetts DEP and US EPA guidelines and will be maintained on a weekly basis during construction. A Detail is included in the Site Plans prepared for the Project.

Sediment Traps/Basins:

Sediment basins and rock dams can be used to capture sediment from stormwater runoff before it leaves a construction site. Both structures allow a pool to form in an excavated or natural depression, where sediment can settle. The pool is dewatered through a single riser and drainage hole leading to a suitable outlet on the downstream side of the embankment or through the gravel of the rock dam. Design a sediment trap to maximize the surface area for infiltration and sediment settling. This increases the effectiveness of the trap and decreases the likelihood of backup during and after periods of high runoff intensity. Site conditions dictate specific design criteria, but the minimum storage capacity should be 1,800 ft^3 per acre of total drainage area (Smolen et al., 1988). The volume of a natural sediment trap can be approximated using the following equation (Smolen et al., 1988): *Volume (ft^3) = 0.4 x surface area (ft^2) x maximum pool depth (ft).* Sediment traps have a useful life of about 18 to 24 months (USEPA, 1993), but their effectiveness depends on the amount and intensity of rainfall and erosion, and proper maintenance.

Dust Control:

Soils information for the site indicates that it is comprised of sandy soils. Therefore, Dust control BMPs to reduce surface activities and air movement that causes dust to be generated from disturbed soil surfaces will be required. The preferred measure for dust control is sprinkling/irrigation. This is an on-going/as-needed requirement until surfaces have been stabilized. There shall be a water truck on-site available as needed.

Diversions:

Temporary diversion swales and mounds will be constructed to divert stormwater away from areas under construction to limit sediment transport. These diversions will be relocated as construction progresses. Stone check dams will be installed in swales as necessary to limit scour and sediment transport.

Catch Basin Protection:

Temporary inlet protection barriers consisting of Silt Sacks® will be placed within all constructed inlets to prevent inflow of sediments into the constructed drainage system. The barriers shall remain in place until a permanent cover is established or diversions away from the inlets are constructed. The barriers shall be observed and maintained as necessary on a weekly basis and after every rainfall of 0.5 inches or more.

Infiltration Basin:

Rope or fence off the area selected for the infiltration basin. Never allow construction equipment to drive across the area intended to serve as an infiltration basin. During Construction, the basin shall be observed during and after all storm events to ensure there is no sediment accumulation or degradation of infiltrative surfaces. Never use infiltration basin as temporary sediment traps for construction activities. To limit smearing or compacting soils, never construct the basin in winter or when it's raining. If the basin floor becomes compacted or smeared during construction, the area shall be tilled to a depth of 12 inches to restore infiltration rates prior to final grading. The Infiltration Basin shall be maintained by the Homeowners association of the subdivision.

Spill Control:

A contingency plan to address the spillage/release of petroleum products and any hazardous materials will be implemented for the site during construction. The plan will include the following measures:

- Equipment necessary to quickly attend to inadvertent spills or leaks shall be on-site in a secure but accessible location. Such equipment will include, but not be limited to, the following: urethane drain cover seals (mats), a spill containment kit which includes sand and shovels, suitable absorbent materials, storage containers, safety goggles, chemically resistant gloves and overshoe boots, water and chemical fire extinguishers, and first aid equipment.
- Spills or leaks will be treated properly according to material type, volume of spillage and location of spill. Mitigation will include preventing further spillage, containing any spilled material to the smallest practical area, removing spilled material in a safe and environmentally friendly manner, and remediating any damage to the environment.
- The contractor shall be familiar with the reporting requirements of the Massachusetts Contingency Plan (310 CMR 40.00) as issued by the Massachusetts Department of Environmental Protection (DEP); specifically Subpart C Notification of Releases and Threats of Release of Oil and Hazardous Materials and Subpart D Preliminary Response Activities and Risk Reduction Measures.
- For any large spills. The Massachusetts DEP Hazardous Waste Incident Response Group shall be notified immediately at 1-617-792-7653 and an emergency response contractor will be called in.

Post-Construction Period Operation and Maintenance:

Catch Basin and Manhole Maintenance:

Activity	Inspection Frequency
Inspect Units	2 Times per year
Clean Units	Whenever the depth of deposits is greater than ½ the sump depth (1 time per yr minimum)

Street Sweeping:

Activity	Inspection Frequency
Sweeping Paved surfaces	2 time per yr (spring & fall). Sweeping along South Street shall be done when necessary (no tracking of materials onto the street shall be allowed)

CDS Treatment Unit:

Activity	Inspection Frequency
Inspect Inlet and Outlet	2 time per yr. After a heavy rain event 1" storm or larger
Inspect Access Ports for Sediment buildup & Cleanup	2 times per yr. Accumulated sediment buildup shall be Vacuumed cleaned as necessary

Retention Basin:

Activity	Inspection Frequency
Sediment Removal	Inspect Monthly Remove accumulated sediment buildup Grass Mowing during growing season (Keep grasses no greater than 6 inches & no lower than 3 to 4 inches)

Infiltration Chambers:

Activity	Inspection Frequency
Inspect Inlet and Outlet	2 times per yr. After a heavy rain event 1" storm or larger
Inspect Access Ports for Sediment buildup & cleanup	2 times per yr. Accumulated sediment buildup shall be

Stormwater Outlet Structure:

Activity	Inspection Frequency
Inspect Outlet	1 time per yr. Remove accumulated sediment buildup at outlet and overgrown vegetation around the outlet.

Stormwater Construction Site Inspection Report

General Information			
Project Name	The Residences at Burns Avenue		
MA DEP File No.		**Location**	Burns Ave/Union St, Walpole, MA
Date of Inspection		**Start/End Time**	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Inspector's Qualifications			
Describe present phase of construction			
Type of Inspection: ❑ Regular ❑ Pre-storm event ❑ During storm event ❑ Post-storm event			
Weather Information			
Has there been a storm event since the last inspection? ❑Yes ❑No **If yes, provide:** Storm Start Date & Time: Storm Duration (hrs): Approximate Amount of Precipitation (in):			
Weather at time of this inspection? ❑ Clear ❑Cloudy ❑ Rain ❑ Sleet ❑ Fog ❑ Snowing ❑ High Winds ❑ Other: Temperature:			
Have any discharges occurred since the last inspection? ❑Yes ❑No **If yes, describe:**			
Are there any discharges at the time of inspection? ❑Yes ❑No **If yes, describe:**			

Site-specific BMPs

- *Number the structural and non-structural BMPs identified in your SWPPP on your site map and list them below (add as many BMPs as necessary). Carry a copy of the numbered site map with you during your inspections. This list will ensure that you are inspecting all required BMPs at your site.*
- *Describe corrective actions initiated, date completed, and note the person that completed the work in the Corrective Action Log.*

	BMP	BMP Installed?	BMP Maintenance Required?	Corrective Action Needed and Notes
1		❑Yes ❑No	❑Yes ❑No	
2		❑Yes ❑No	❑Yes ❑No	
3		❑Yes ❑No	❑Yes ❑No	
4		❑Yes ❑No	❑Yes ❑No	
5		❑Yes ❑No	❑Yes ❑No	
6		❑Yes ❑No	❑Yes ❑No	
7		❑Yes ❑No	❑Yes ❑No	
8		❑Yes ❑No	❑Yes ❑No	
9		❑Yes ❑No	❑Yes ❑No	
10		❑Yes ❑No	❑Yes ❑No	
11		❑Yes ❑No	❑Yes ❑No	

	BMP	BMP Installed?	BMP Maintenance Required?	Corrective Action Needed and Notes
12		❑Yes ❑No	❑Yes ❑No	
13		❑Yes ❑No	❑Yes ❑No	
14		❑Yes ❑No	❑Yes ❑No	
15		❑Yes ❑No	❑Yes ❑No	
16		❑Yes ❑No	❑Yes ❑No	
17		❑Yes ❑No	❑Yes ❑No	
18		❑Yes ❑No	❑Yes ❑No	
19		❑Yes ❑No	❑Yes ❑No	
20		❑Yes ❑No	❑Yes ❑No	

Overall Site Issues

Below are some general site issues that should be assessed during inspections. Customize this list as needed for conditions at your site.

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
1	Are all slopes and disturbed areas not actively being worked properly stabilized?	❑Yes ❑No	❑Yes ❑No	
2	Are natural resource areas (e.g., streams, wetlands, mature trees, etc.) protected with barriers or similar BMPs?	❑Yes ❑No	❑Yes ❑No	
3	Are perimeter controls and sediment barriers adequately installed (keyed into substrate) and maintained?	❑Yes ❑No	❑Yes ❑No	
4	Are discharge points and receiving waters free of any sediment deposits?	❑Yes ❑No	❑Yes ❑No	
5	Are storm drain inlets properly protected?	❑Yes ❑No	❑Yes ❑No	
6	Is the construction exit preventing sediment from being tracked into the street?	❑Yes ❑No	❑Yes ❑No	
7	Is trash/litter from work areas collected and placed in covered dumpsters?	❑Yes ❑No	❑Yes ❑No	
8	Are washout facilities (e.g., paint, stucco, concrete) available, clearly marked, and maintained?	❑Yes ❑No	❑Yes ❑No	

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
9	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other deleterious material?	❑Yes ❑No	❑Yes ❑No	
10	Are materials that are potential stormwater contaminants stored inside or under cover?	❑Yes ❑No	❑Yes ❑No	
11	Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	❑Yes ❑No	❑Yes ❑No	
12	(Other)	❑Yes ❑No	❑Yes ❑No	

Non-Compliance

Describe any incidents of non-compliance not described above:

CERTIFICATION STATEMENT

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name and title: _____

Signature:_____ **Date:**_____

Appendix A

Maintenance Manuals

Contactor® & Recharger®
Stormwater Chambers

Operation and Maintenance Guidelines
for CULTEC Stormwater Management Systems

The Founder of Plastic Chamber Technology

www.cultec.com | 1(800) 4-CULTEC |

CULTEC®

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Contact Information:
For general information on our other products and services, please contact our offices within the United States at (800)428-5832, (203)775-4416 ext. 202, or e-mail us at custservice@cultec.com.

For technical support, please call (203)775-4416 ext. 203 or e-mail tech@cultec.com.

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Doc ID: CULG008 05-17
May 2017

These instructions are for single-layer traffic applications only. For multi-layer applications, contact CULTEC.
All illustrations and photos shown herein are examples of typical situations. Be sure to follow the engineer's drawings.
Actual designs may vary.

This manual contains guidelines recommended by CULTEC, Inc. and may be used in conjunction with, but not to supersede, local regulations or regulatory authorities. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Introduction

The CULTEC Subsurface Stormwater Management System is a high-density polyethylene (HDPE) chamber system arranged in parallel rows surrounded by washed stone. The CULTEC chambers create arch-shaped voids within the washed stone to provide stormwater detention, retention, infiltration, and reclamation. Filter fabric is placed between the native soil and stone interface to prevent the intrusion of fines into the system. In order to minimize the amount of sediment which may enter the CULTEC system, a sediment collection device (stormwater pretreatment device) is recommended upstream from the CULTEC chamber system. Examples of pretreatment devices include, but are not limited to, an appropriately sized catch basin with sump, pretreatment catchment device, oil grit separator, or baffled distribution box. Manufactured pretreatment devices may also be used in accordance with CULTEC chambers. Installation, operation, and maintenance of these devices shall be in accordance with manufacturer's recommendations. Almost all of the sediment entering the stormwater management system will be collected within the pretreatment device.

Best Management Practices allow for the maintenance of the preliminary collection systems prior to feeding the CULTEC chambers. The pretreatment structures shall be inspected for any debris that will restrict inlet flow rates. Outfall structures, if any, such as outlet control must also be inspected for any obstructions that would restrict outlet flow rates. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Operation and Maintenance Requirements

I. Operation

CULTEC stormwater management systems shall be operated to receive only stormwater run-off in accordance with applicable local regulations. CULTEC subsurface stormwater management chambers operate at peak performance when installed in series with pretreatment. Pretreatment of suspended solids is superior to treatment of solids once they have been introduced into the system. The use of pretreatment is adequate as long as the structure is maintained and the site remains stable with finished impervious surfaces such as parking lots, walkways, and pervious areas are properly maintained. If there is to be an unstable condition, such as improvements to buildings or parking areas, all proper silt control measures shall be implemented according to local regulations.

II. Inspection and Maintenance Options

A. The CULTEC system may be equipped with an inspection port located on the inlet row. The inspection port is a circular cast box placed in a rectangular concrete collar. When the lid is removed, a 6-inch (150 mm) pipe with a screw-in plug will be exposed. Remove the plug. This will provide access to the CULTEC Chamber row below. From the surface, through this access, the sediment may be measured at this location. A stadia rod may be used to measure the depth of sediment if any in this row. If the depth of sediment is in excess of 3 inches (76 mm), then this row should be cleaned with high pressure water through a culvert cleaning nozzle. This would be carried out through an upstream manhole or through the CULTEC StormFilter Unit (or other pretreatment device). CCTV inspection of this row can be deployed through this access port to deter mine if any sediment has accumulated in the inlet row.

B. If the CULTEC bed is not equipped with an inspection port, then access to the inlet row will be through an upstream manhole or the CULTEC StormFilter.

1. Manhole Access
This inspection should only be carried out by persons trained in confined space entry and sewer inspection services. After the manhole cover has been removed a gas detector must be lowered into the manhole to ensure that there are not high concentrations of toxic gases present. The inspector should be lowered into the manhole with the proper safety equipment as per OSHA requirements. The inspector may be able to observe sediment from this location. If this is not possible, the inspector will need to deploy a CCTV robot to permit viewing of the sediment.

2. StormFilter Access
Remove the manhole cover to allow access to the unit. Typically a 30-inch (750 mm) pipe is used as a riser from the StormFilter to the surface. As in the case with manhole access, this access point requires a technician trained in confined space entry with proper gas detection equipment. This individual must be equipped with the proper safety equipment for entry into the StormFilter. The technician will be lowered onto the StormFilter unit. The hatch on the unit must be removed. Inside the unit are two filters which may be removed according to StormFilter maintenance guidelines. Once these filters are removed the inspector can enter the StormFilter unit to launch the CCTV camera robot.

C. The inlet row of the CULTEC system is placed on a polyethylene liner to prevent scouring of the washed stone beneath this row. This also facilitates the flushing of this row with high pressure water through a culvert cleaning nozzle. The nozzle is deployed through a manhole or the StormFilter and extended to the end of the row. The water is turned on and the inlet row is back-flushed into the manhole or StormFilter. This water is to be removed from the manhole or StormFilter using a vacuum truck.

III. Maintenance Guidelines

The following guidelines shall be adhered to for the operation and maintenance of the CULTEC stormwater management system:

A. The owner shall keep a maintenance log which shall include details of any events which would have an effect on the system's operational capacity.

B. The operation and maintenance procedure shall be reviewed periodically and changed to meet site conditions.

C. Maintenance of the stormwater management system shall be performed by qualified workers and shall follow applicable occupational health and safety requirements.

D. Debris removed from the stormwater management system shall be disposed of in accordance with applicable laws and regulations.

IV. Suggested Maintenance Schedules

A. Minor Maintenance
The following suggested schedule shall be followed for routine maintenance during the regular operation of the stormwater system:

Frequency	Action
Monthly in first year	Check inlets and outlets for clogging and remove any debris, as required.
Spring and Fall	Check inlets and outlets for clogging and remove any debris, as required.
One year after commissioning and every third year following	Check inlets and outlets for clogging and remove any debris, as required.

B. Major Maintenance
The following suggested maintenance schedule shall be followed to maintain the performance of the CULTEC stormwater management chambers. Additional work may be necessary due to insufficient performance and other issues that might be found during the inspection of the stormwater management chambers. (See table on next page)

	Frequency	Action
Inlets and Outlets	Every 3 years	• Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.
	Spring and Fall	• Check inlet and outlets for clogging and remove any debris as required.
CULTEC Stormwater Chambers	2 years after commissioning	• Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique. • Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.
	9 years after commissioning every 9 years following	• Clean stormwater management chambers and feed connectors of any debris. • Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique. • Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended.
	45 years after commissioning	• Clean stormwater management chambers and feed connectors of any debris. • Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required. • Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique. • Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection. • Attain the appropriate approvals as required. • Establish a new operation and maintenance schedule.
Surrounding Site	Monthly in 1st year	• Check for depressions in areas over and surrounding the stormwater management system.
	Spring and Fall	• Check for depressions in areas over and surrounding the stormwater management system.
	Yearly	• Confirm that no unauthorized modifications have been performed to the site.

For additional information concerning the maintenance of CULTEC Subsurface Stormwater Management Chambers, please contact CULTEC, Inc. at 1-800-428-5832.

CONTECH®
ENGINEERED SOLUTIONS

CDS® Inspection and Maintenance Guide

CDS TECHNOLOGIES

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes.

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y^3	m^3
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.3	3.0	0.9	1.3	1.0
CDS2020	5	1.3	3.5	1.1	1.3	1.0
CDS2025	5	1.3	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Support

- Drawings and specifications are available at www.contechstormwater.com.
- Site-specific design support is available from our engineers.

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, earth stabilization and wastewater treament products. For information, visit www.ContechES.com or call 800.338.1122

CONTECH®
ENGINEERED SOLUTIONS
800.925.5240
www.ContechES.com

CDS Inspection & Maintenance Log

CDS Model: _____ Location: _____

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.**

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

APPENDIX – E

Illicit Discharge Statement

Standard 10

Illicit Discharge Compliance Statement

The Residences at Burns Avenue
Walpole, Massachusetts

May 21, 2020

This statement is provided in accordance with the provisions of the Massachusetts Stormwater Management Standard #10.

To the best of the applicant's/owners knowledge there are no illicit discharges to the site's stormwater manangement system.

All proposed uses on the site will not generate, store or discharge any pollutants to the groundwater and/or wetland resource areas.

Any illicit discharges identified during or after construction will be terminated immediately.

Applicant/Owner:

Wall Street Development Corp.
Attn: Lou Petrozzi
P.O Box 272
Westwood, MA 02090
Phone: 508-326-0360

_____ _____

Lou Petrozzi Date

APPENDIX - F

Stormwater Pollution Prevention Plan

(to be submitted prior to construction)

APPENDIX – G

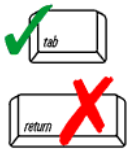
Checklist for Stormwater Report

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

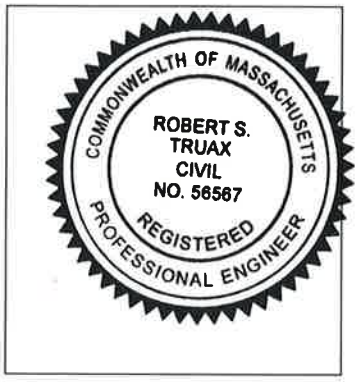
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development

☐ Redevelopment

☒ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

☒ No disturbance to any Wetland Resource Areas

☒ Site Design Practices (e.g. clustered development, reduced frontage setbacks)

☐ Reduced Impervious Area (Redevelopment Only)

☒ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

- ☐ Credit 1
- ☐ Credit 2
- ☐ Credit 3

☐ Use of "country drainage" versus curb and gutter conveyance and pipe

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☐ Other (describe): _____

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth

☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☒ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☒ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☐ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☐ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

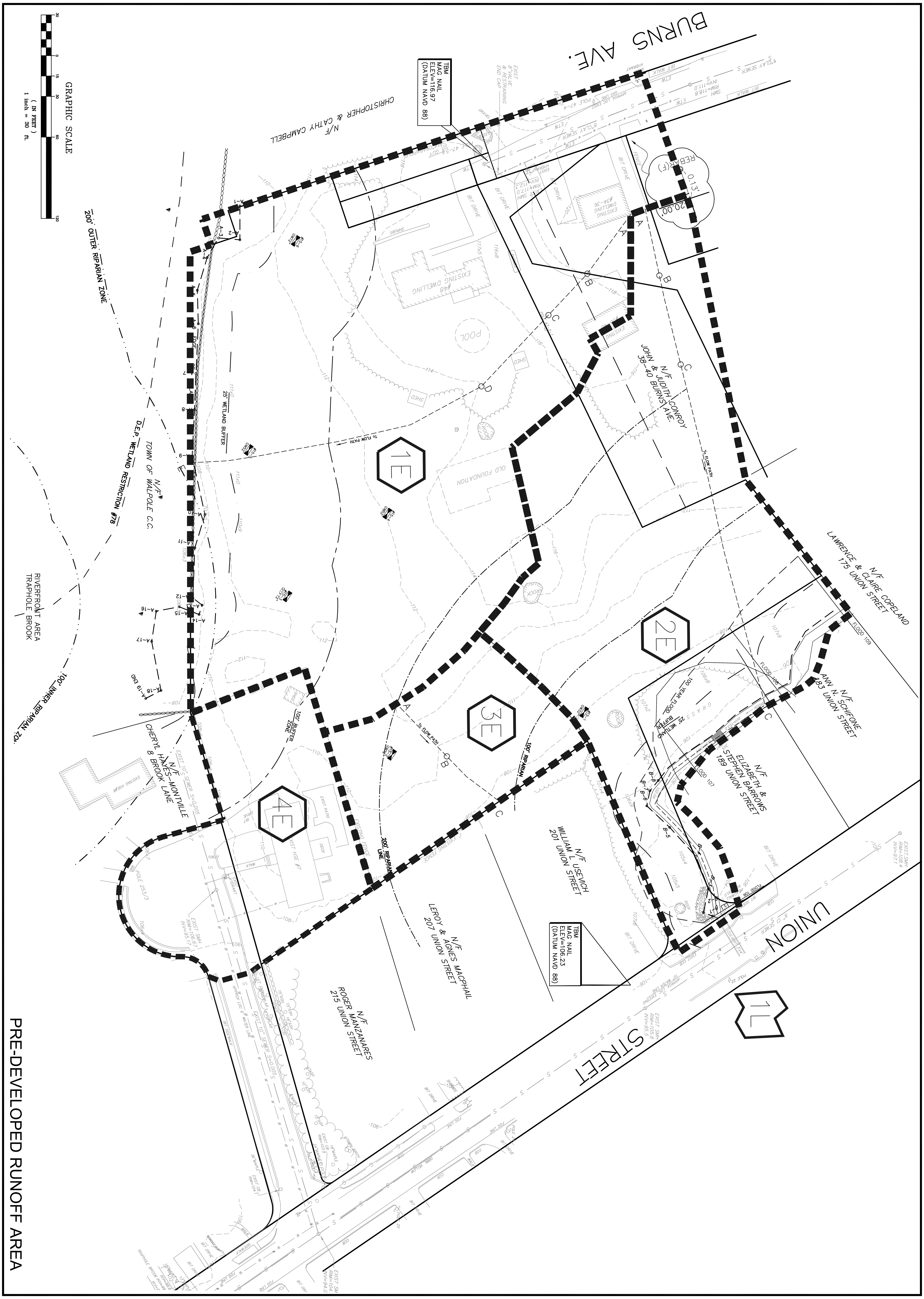
☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

APPENDIX – H

Pre-Development Subcatchment Areas
Post-Development Subcatchment Areas
Hydraulic Subcatchment Areas



SITE PLAN OF LAND
"THE RESIDENCES AT BURNS AVENUE"
WALPOLE, MASSACHUSETTS

APPLICANT:

WALL STREET DEVELOPMENT CORP.
P.O. BOX 272
WESTWOOD, MA 02090

GLM Engineering Consultants, Inc.
19 EXCHANGE STREET
HOLLISTON, MA 01746
P: 508–429–1100
F: 508–429–7160
www.GLMengineering.com

DRW.: rst

JOB No. 15,588

DATE: MAY 21, 2020

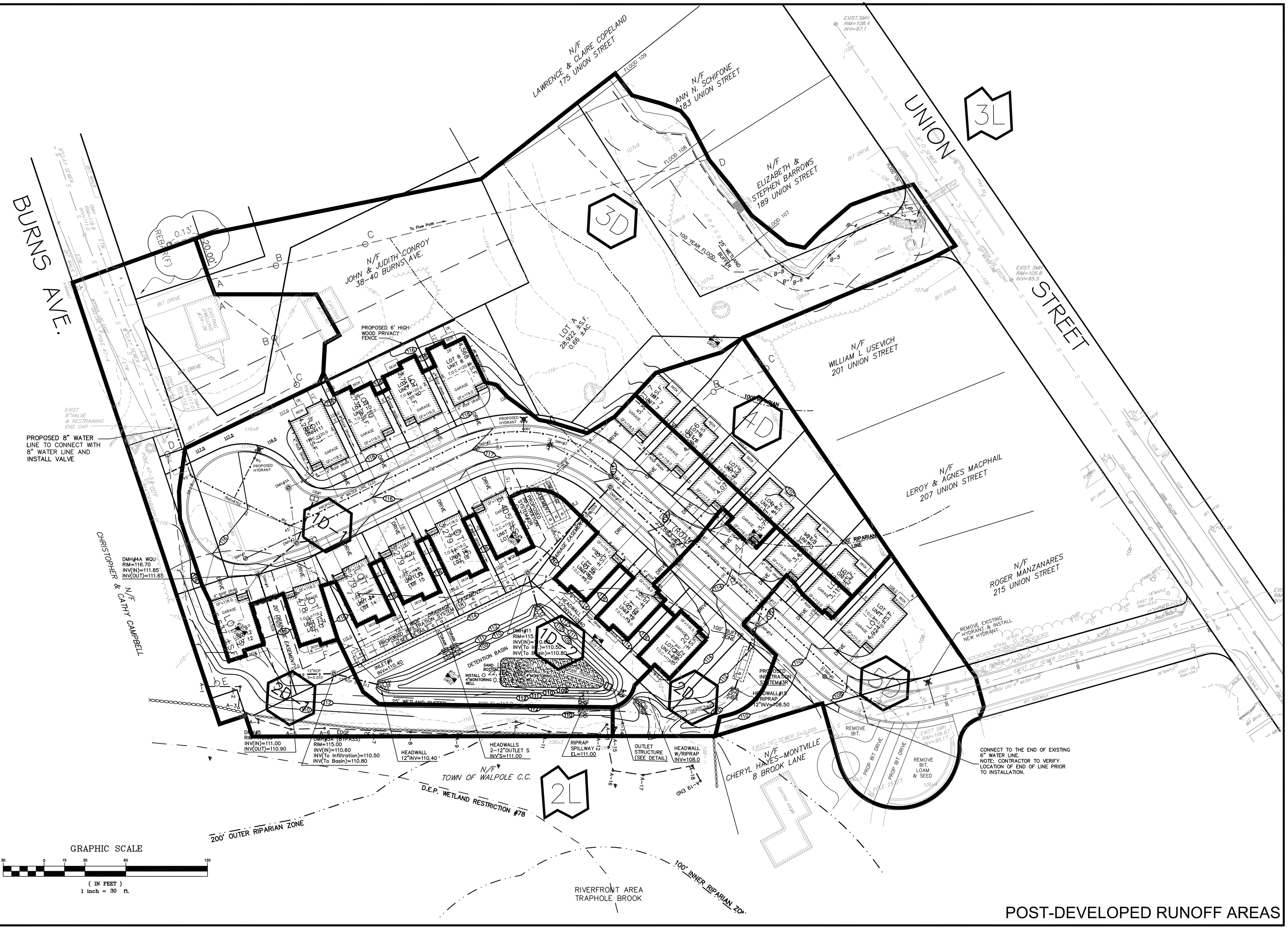
SCALE: 1"= 30'

SHEET: 1 OF 3

PLAN #: 27,096

REVISIONS

No.	DATE	DESCRIPTION
1	02/08/2022	ZBA UPDATED PLANS
2	02/23/22	ZBA COMMENTS, REDUCE TO 38 UNITS
3	05/05/22	20 LOT RESIDENTIAL SUBDIVISION



POST-DEVELOPED RUNOFF AREAS

REVISIONS		
No.	DATE	DESCRIPTION
1	02/08/2022	ZBA UPDATED PLANS
2	02/23/22	ZBA COMMENTS, REDUCE TO 38 UNITS
3	05/05/22	20 LOT RESIDENTIAL SUBDIVISION

SITE PLAN OF LAND
"THE RESIDENCES AT BURNS AVENUE"
WALPOLE, MASSACHUSETTS

APPLICANT:
WALL STREET DEVELOPMENT CORP.
P.O. BOX 272
WESTWOOD, MA 02090

GLM Engineering Consultants, Inc.
19 EXCHANGE STREET
HOLLISTON, MA 01746
P: 508-429-1100
F: 508-429-7160
www.GLMengineering.com

DRW.:	rst
JOB No.	15,588
DATE:	MAY 21, 2020
SCALE:	1"= 30'
SHEET:	2 OF 3
PLAN #:	27,096

OWNERS OF RECORD:
1. MAP 20, PARCEL 119
   WALL STREET DEV. CORP.
   P.O. BOX 272
   WESTWOOD, MA 02090
2. MAP 20, PARCEL 136
   WILLIAM & SUSAN FELTON
   48 BURNS AVE.
   WALPOLE, MA 02081
3. MAP 20, PARCEL 137
   ELAINE FIORIO & JAMES DELUTIS
   27 GRANITE STREET
   WALPOLE, MA 02081

ASSESSOR'S REFERENCE:
MAP 20, PARCEL 119
MAP 20, PARCEL 136
MAP 20, PARCEL 137

DEED REFERENCE:
NORFOLK COUNTY REGISTRY OF DEEDS
Bk. rstxx, Pg. rst

PLAN REFERENCE:
PLAN No. xx OF rstx, Bk. rstx, Pg.

ZONING CLASSIFICATION:
GENERAL RESIDENCE – GR
15,000 S.F. (Single Family)
30,000 S.F. (Three Family)
(10,000 s.f each additional unit)
SETBACKS:
FRONT: 30'
SIDE: 10'
REAR: 30'

LEGEND:

- EXISTING CONTOUR
- EXISTING SPOT ELEVATION
- EXISTING WATER GATE
- EXISTING TREE LINE
- EXISTING WETLAND FLAG
- EXISTING TEST PIT LOCATION
- PROPOSED CONTOUR
- PROPOSED SPOT ELEVATION
- PROPOSED HYDRANT
- PROPOSED DRAIN MANHOLE
- PROPOSED CATCH BASIN
- PROPOSED DOUBLE CATCHBASIN
- PROPOSED SEWER LINE
- PROPOSED SEWER MANHOLE
- PROPOSED WATER LINE
- PROPOSED STREET TREE
- PROPOSED CAPE COD BERM
- PROPOSED SEWER SERVICE
- PROPOSED WATER SERVICE

GRAPHIC SCALE
30 0 15 30 60 120
(IN FEET)
1 inch = 30 ft.

DIG SAFE 1-888-344-7233

NOTE: IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY LOCATIONS AND ELEVATIONS OF EXISTING UTILITIES PRIOR TO COMMENCEMENT OF ANY CONSTRUCTION. DIGSAFE IS TO BE NOTIFIED 72 WORKING HOURS IN ADVANCE OF CONSTRUCTION. DIGSAFE 1-888-344-7233

DRAINAGE AREAS

REVISIONS

No.	DATE	DESCRIPTION
1	02/08/2022	ZBA UPDATED PLANS
2	02/23/22	ZBA COMMENTS, REDUCE TO 38 UNITS
3	05/05/22	20 LOT RESIDENTIAL SUBDIVISION

SITE PLAN OF LAND
"THE RESIDENCES OF BURNS AVENUE"
WALPOLE, MASSACHUSETTS

APPLICANT:
WALL STREET DEVELOPMENT CORP.
P.O. BOX 272
WESTWOOD, MA 02090

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DRW.:	rst
JOB No.	15,588
DATE:	MAY 21, 2020
SCALE:	1"= 30'
SHEET:	3 of 3
PLAN #:	27,096